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FOUNDRY TRADE JOURNAL

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An Index of Foundry Activities

Members of the Foundry Equipment and Supplies Association were last week circularized with a document from the Board of Trade which revealed some interesting and important figures. From returns made by 48 foundry-equipment manufacturers, covering the fourth quarter of last year, it was seen that foundry equipment to the value of £1,370,000 was delivered, of which £308,000 was for export. This figure includes such items as sand-preparing machines; moulding machines and boxes; shotblast plant; melting equipment; coremaking machines and "other equipment including chaplets and studs, but excluding mechanical-handling plant or mechanization and materials such as abrasives." Obviously the inclusion of mechanical-handling equipment would bring the yearly total in excess of £2,000,000.

The major items of British foundry equipment which have found favour amongst foreign customers are: sand-preparing plants (£111,000), and moulding machines and boxes (£114,000), with shotblast plant taking third place, though we believe the last named should gain ground in the future, as a mere £30,000 in one quarter does not represent the potential. Goods which are only merchanted or factored are excluded from the above figures.

These exports seem to be very commendable, when it is realized that this business has been built up since the war, before which the UK was largely an importing country for foundry equipment. Moreover, a not insignificant range of plant is manufactured in this country by agreement with American houses, which precludes exporting to certain markets—usually Europe, and reciprocally prevents import to this country of the American-made article. This provides an interesting facet, when considering the European common market. The method has the advantage of not only eliminating a certain amount of competition in the licensee's market, but also of ensuring that manufacture is to the standards in vogue in his territory, though it does cut clean across the notion of a common European market. The £1,000,000 worth of plant supplied to the home market during the final quarter of 1956 shows that the foundry industry is continuing to equip itself to manufacture more economically. Yet we doubt whether all this activity will provide sufficient money through direct taxation to sustain even one minor item of Government expenditure. Thus to enable comparatively new businesses (such as foundry equipment) to be in a position to compete in overseas markets, reduced taxation is a prerequisite.

Correspondence

DUST CONTROL ON PEDESTAL GRINDING MACHINES

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—In the issue of your JOURNAL dated October 4, 1956, an article was published dealing with the British Steel Casting Research Association system of dust control on grinding machines and in the preamble it is stated that:—

"Sir George Barnett has now approved for universal application . . ." this system.

It is important that it should be understood that I am unable to grant any such approval and that the statement is not based upon any approval given by me. The system is a development of previous methods of dust control upon which I had indicated clearly to the Association that it was unlikely to comply with the law when used in ironfoundry processes and after this development I informed the Association that there was no longer need for this prohibition. The claim by anyone that this represents "approval by me" should not be made.

There is the further relevant aspect: other devices, and in particular the device developed by the British Cast Iron Research Association and known commercially as the "Dusgard," are available for use in foundries. Each device may be suitable or unsuitable as local circumstances apply, and to indicate my approval of any one device without reference to the particular use is misleading.

I should be obliged if you would give this letter the same publicity as was given to the article of October 4, 1956, so that your readers may make the correct interpretation of that article.—Yours, etc.,

G. P. BARNETT,
H.M. Chief Inspector of Factories.

H.M. Factory Inspectorate,
Ministry of Labour and National Service,
19, St. James's Square.
London, S.W.1.

March 19, 1957.

Forty Years Ago

In the March 1917 issue of the FOUNDRY TRADE JOURNAL, the Editor commented on the appointment by the firm of Denny of Dumbarton of a welfare supervisor. This must surely have been amongst the earliest efforts in this direction in the foundry industry. In the same issue, during a discussion on the function of feeders and denseners, Mr. Pemberton took exception to a remark by Mr. Cook about design, saying that Mr. Cook had said that everyone knew of the importance of proper designing of thick and thin sections, but, in fact, everyone *did not know* or there would not have been such abnormal designs as founders had to deal with. (This would seem still to be a "hardy perennial"). Amongst new companies listed in the issue appeared the name of Associated British Machine Tool Makers, Limited.

ON THURSDAY, APRIL 11, the BBC outside broadcast cameras from Cardiff will visit Llandaff Cathedral to see how the work of restoration has been done and to show viewers the new Epstein statue which is sited on the organ gallery. The statue, "Christ in Majesty," is one of the main features of the restoration. It is 18-ft. high and was cast last year, in aluminium, by the Morris Singer Company, Limited, London.

State Grant for Scots Firm

After visiting a number of industrial estates in Glasgow and district earlier this month, Sir David Eccles, President of the Board of Trade, said that the Government would finance extensions costing £300,000, at the premises of Euclid (Great Britain) Limited, Newhouse Industrial Estate, Lanarkshire. The extension would mean that the present labour force of approximately 1,000 would be increased by about 300. At Newhouse they were producing similar machines to those made by the American concern, but they were beating their American "parents" in the Canadian market. When the factory of the Caterpillar Tractor Company, Limited, was in production, he added, the area would be the largest producer of earth-moving equipment outside the US.

Referring to the European free trade area Sir David said that Scotland, with its experience and engineering and technical equipment, would be as well placed as any industrial area in western Europe to contribute to the expansion that would follow the reduction in trade barriers. "Even if we do nothing, we cannot avoid the risks which the proposals for a European common market would involve for our industry, but through the British proposals it should be within our power immensely to increase the opportunities," he said.

From Ore to Blast Furnace on TV

Stages from the securing of iron ore to the tapping of the world's biggest blast-furnace at Scunthorpe will be seen on BBC television on April 3, when a new weekly series "Now" will be inaugurated. The first programme entitled "Two Miles Under," will start at the working face of the Dragonby Mine, near Scunthorpe, two miles under the earth. Cameras, lights, microphones, and mobile-control room will be taken along the tunnels to the working face, and seven sets of two-mile long cables will be needed, because the surrounding iron-ore makes radio links impossible. Rock boring and the carrying away of the ore will be seen by viewers. The present output from the mine is 12,000 tons a week, achieved with a labour force of 150. There will be shots from the Appleby-Frodingham works and the Queen Anne blast-furnace will be shown being tapped. Here, the cameramen and commentator will wear special protective clothing. Raymond Baxter will give the commentary from the mine, and Berkeley Smith at the blast furnace.

Latest Foundry Statistics

It is learnt from the Iron and Steel Board that the production of steel castings in 1956 was 331,421 tons, an increase over 1955 of the order of 6.2 per cent.

As reported by the British Bureau of Non-Ferrous Metal Statistics, the output of copper-base castings during January was 7,055 tons; in January 1956, the production was 6,733 tons. The output of pure-copper castings was returned at 650 tons.

According to the Council of Ironfoundry Associations, employment in ironfoundries during the week ending February 2 totalled 139,833 that is 425 fewer than on December 29 and 6,672 fewer than a year ago.

AN INTERNATIONAL AUTOMATION CONGRESS will be held in New York City, June 9 to 13, 1958, as an adjunct of the fourth International Automation Exposition. The Exhibition will be held in New York's new Coliseum during the entire week.

Elevated-temperature Testing of Moulding and Core Sands and Correlation with Casting Quality*

By Harry W. Dietert, V. M. Rowell and A. L. Graham

During the past ten years, significant progress has been made in the development of high-temperature tests on moulding sands that will correlate with common casting defects. These developments have been reported in the form of official reports by AFS committees and in a number of papers published by individual investigators. This material has been added to the sum total of foundry technical literature, but little effort has been made to bring the results into a collected form suitable for use by the practical foundryman. Lacking proper understanding of the relationship between the various defects and the methods of control, only a small portion of the foundry industry is making full use of the hard-won progress. This Paper is essentially a review of the situation and an attempt to fit research data into the context of daily foundry experience. While it is impossible to acknowledge all of the individual committee members who have contributed to the developments discussed herein, the Authors attempt to credit the committees that have been direct sources of information.

Casting Defect Formation

In order to identify and control casting defects, the foundryman must have some understanding of the mechanisms causing them. Unfortunately, this is a subject filled with "unknowns," but there is some general agreement about a number of defects and it might be well to discuss briefly the theories commonly accepted.

When molten metal enters the mould cavity, a number of forces come into play which tend to destroy the mould. These forces include the hot gases produced by the heating of the mould, expansion of the sand grains, and effect on the mould of the flowing metal itself. When metal flows into a mould cavity, its turbulence and shearing action against the mould walls tend to scour the mould surface and tear the sand grains one from another. Wherever the intergranular bond fails, and the grains are displaced, there is a void in the smooth mould-face and a resultant imperfection in the casting, requiring additional cleaning effort. This type of defect generally appears where the metal has the highest velocity, especially if there be a "nozzle" effect. These defects may be placed in the category of erosion defects and can often be identified by their location and by the presence of sand imbedded in the casting at some other point "downstream," or above the original void. Cuts and washes and erosion (or type-B) scabs fall into this group.

By virtue of its kinetic energy and static pressure, the molten metal also tends to deform the mould mechanically and change the dimensions of the cavity. This, of course, affects the weight and size of the finished casting. Mould growth or distortion is seldom considered as a surface defect and since much of the mould deformation occurs in the cool sub-surface sand, the proper approach to investigating this problem lies in applying room temperature testing. The destructive effects caused as a result of the high temperature of the molten metal are especially serious in producing casting defects, as many of the common casting faults are due to the instability of the sand mix at high temperatures. The heat produces a breakdown or an alteration in the binders and promotes expansion of the sand grains; this may produce internal stresses too great for the rammed-sand mass to withstand, and then, the mould surface will fail. Failure can occur in a number of forms such at rat-tails, buckles, or scabs, the relationship between these being illustrated in Fig. 1.

In eliminating defects, the foundryman must either reduce the magnitude of the disruptive forces, or increase the magnitude of the restraining forces. In any event, the foundryman has to be able to measure the basic properties and high-temperature reaction of the sand used as a guide to instituting proper control. Ideally, the same tests should also be of value in predicting defects, so that the foundryman can take corrective measures before the sand becomes an immediate problem.

Tests and Equipment

A number of tests have been developed that measure the ability of a sand to withstand compressive loading at high temperatures, the magnitude of the expansion at various temperatures and the amount of deformation that a sand will undergo before collapse. In the following paragraphs these tests will be discussed as they apply to the individual defects.

In order to measure the properties of foundry sands at elevated temperatures, a foundry laboratory should be equipped with a number of specialized

* Exchange Paper from the American Foundrymen's Society, presented at the International Foundry Congress, Düsseldorf. The Authors are respectively chairman, vice-president and research engineer of the Harry W. Dietert Company, of Detroit, USA. Mr. Dietert is also vice-president of the AFS.

High-temperature Testing of Sands

instruments. The basic unit should be a high-temperature furnace combined with a loading system capable of breaking the sand specimens in compression at any temperature up to the pouring temperature of the molten metal to be dealt with. Suitable equipment should also be provided for measuring hot deformation and expansion. Fig. 2 illustrates one basic type of testing apparatus commercially available for the high-temperature testing of sand. This unit is known as the Dietert "Thermolab"; it has a furnace giving a range from room temperature to 1,650 deg. C. This is equipped with a sensitive temperature-controller and is constructed so that the hot zone is accessible from the side or from below. The apparatus has a hydraulic loading-system capable of applying a compressive load as high as 5,000 lb. per sq. in. on a 1¼-in. dia. standard sand specimen. The load is applied

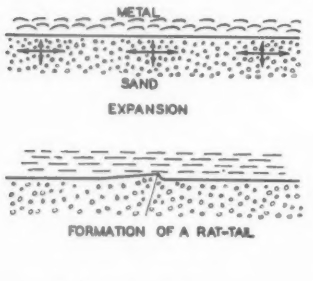


FIG. 1. — *Four main forms of failure at a mould surface*

hydraulically but measured mechanically to give maximum accuracy. Through a simple adjustment to the mechanical linkage, the range can be varied from 0 to 50, 0 to 500 or 0 to 5,000 lb. per sq. in. A basic unit of this type can be used for the determination of hot compression-strength, retained strength, hot-collapsibility under load, penetration, spalling and sintering point of sands. With the proper ancilliary equipment, it can be used to determine the expansion of a sand, the hot deformation and the expansion load. Other accessories are available commercially for the testing of hot permeability, gas volume and pressure when hot. These tests are valuable for the elimination of "blows" and other gas defects.

The hot deformation, or movement under load at elevated temperatures, may be measured with an indicator or a recorder attached to the apparatus. Fig. 3 shows the Authors' hot-deformation recorder as it would be mounted on another type of their apparatus. Deformation of the sand specimen and the load applied are each measured as a change in the position of the core of a differential transformer. One differential transformer is connected to a moving member in the weighing mechanism and the movement of its core is converted electronically into a proportional movement of the recorder drum. Another differential transformer is linked by a lever system to the lower post assembly of the Thermolab and the movement of this assembly as the sand deforms is converted into a proportional movement of the stylus.

Free- and confined-expansion tests can be made through the use of a unit such as the expansion micrometer shown in Fig. 4. This instrument consists of a quartz frame equipped with a quartz-stem dial indicator. The specimen to be tested is inserted in one end of the frame with quartz discs at each end, and a quartz rod is slipped between the specimen and the dial indicator. The end of the micrometer frame is inserted into the furnace-chamber of the basic apparatus through the horizontal port and the change in length of the specimen is read from the dial indicator.

Types of Scabbing

The first objective in dealing with a scab defect in a casting is to place it in its proper category; to decide whether the defect is an expansion scab (type A), or an erosion scab (type B). This can be done by visual inspection. If the scab forms an integral part of the casting surface, without visible separation between the casting and the defect, it is an erosion scab formed by the metal

FIG. 2.—*Equipment at the Authors' firm for elevated-temperature testing of sand compacts.*

filling the void left by sand which no longer occupies its proper position in the mould surface. This type of scab may be influenced by the degree of expansion in the mould, but is actually related to "cuts" and "washes" in that it is due to the erosion of the mould surface. Since this defect is greatly influenced by the velocity and turbulence of the metal flow in the mould, all scabs found in the vicinity of the gates should be critically examined before assuming that they are expansion scabs, as conditions at this location are especially conducive to erosion.

If visual inspection shows the scab to be separated from the casting mass by a thin layer of sand under most of the defect, this would indicate that it is an expansion (type A) scab. The relationship between this type of defect and the rat-tail or buckle is indicated by the fact that many severe, type A, scabs will have a rat-tail or buckle underneath them, when the scab is chipped away.

Scabbing may have a number of indirect causes that should be considered in setting up a control system. Localized hard-ramming will often produce expansion scabs from an otherwise sound sand mould and localized soft-ramming can produce erosion scabs, cuts, or washes. Wet spots in the mould can produce "swabbing scabs" which may be either expansion- or erosion-type defects. If a box-bar or gagger is too close to the pattern, this will result in a thin sand-section which can also promote scabbing. The causes for these defects lie not only in the sand, but in poor moulding-practice. Any sand mix containing silica sand has inherent scabbing tendencies and the problem is one of degree. Because of other considerations, a foundry may have to use a "borderline" sand from the point of view of scabbing, but this may not be serious as long as adequate control and intelligent judgment are applied by the sand technologist. Swabbing- and ramming-scabs do not require the immediate alteration of the base mix. When recognized they should be dealt with on the moulding floor, not at the sand mixer.

If a sand produces a number of easily recognized expansion-type scabs, and occasionally, an apparent erosion scab near the ingate, the foundryman should not accept the situation at its face value. If an expansion scab is severe enough and is in the path of rapidly-moving metal, the sand that normally would be found under the scab may be washed away, leaving a depression which will produce an apparent erosion-type scab. This condition may be identified by the location, the history of the sand and the absence of a fall in the hot-compression-strength test results. These distinctions must be considered when control tests and methods for predicting the occurrence of these defects are sought.

Erosion-type Scabs

Erosion-type scabs are generally produced when the bond between the sand grains is too low to withstand the pressures applied to the mould surface. For control, the green-compression, dry-compression and air-hardness strengths of the sand

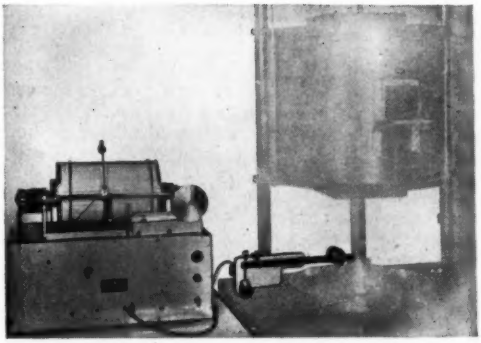


FIG. 3.—*Recorder for plotting hot-deformation stress/strain diagrams for sand.*

should be tested, but in addition, the hot-compression strength and hot-deformation should also be checked over a wide range of temperatures. Failure anywhere from room temperature up to pouring temperature produces dirt inclusions and a rough-surface defect that could be termed a cut, wash or erosion scab. Once identified, this defect may be eliminated through control of the bond additions as called for by the compression strength values. Sands low in refractoriness may give low, hot-compression-strength results below the pouring temperature of the metal without producing erosion defects if the hot-deformation strength is high enough. These sands are plastic at high temperatures, and while they have little resistance to compressive loads, they resist the erosive action of flowing metal because of this plasticity. This condition should be avoided as it may lead to fusion defects, changes in dimension and, indirectly, to centre-line shrinkage. If the condition is brought on by a build-up in sand additives, it should be arrested by dilution with new sand.

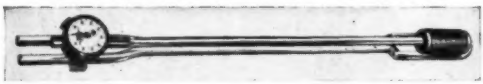


FIG. 4.—*Expansion micrometer, with solid free-expansion specimen in position.*

Other Causes

Occasionally, an erosion defect is caused (or at least influenced) by gases produced during the filling of the mould cavity. In this type of problem, the scab is formed above a green-sand or baked core while the core is being surrounded by metal. While the top of the core is being covered with metal, the gases being liberated cause some agitation of the metal, thereby increasing its erosive action. If this action be accompanied by a reduction in the strength of the binder, it can lead to an erosion-type scab. This sort of scab may be identified by its location and, once identified, eliminated by proper venting of the core, or by reduction in organic

High-temperature Testing of Sands

material in the sand mix, without increasing bond-additions and overall cost. Venting can also eliminate expansion-type scabs in some cases, as the vent holes provide artificial voids for the expanding sand to fill, thereby relieving the internal stresses without failure of the mould surface.

Through daily or weekly control of the hot-compression-strength and hot-deformation, along with regular room-temperature testing, any tendency toward erosion-type scabbing can be observed as a decrease in strength and/or deformation, and steps can be taken to correct the difficulty before the change becomes apparent from a fall in casting quality.

For control testing, the hot-compression-strength test should be run on a 1¼-in. dia., 2-in. long sand specimen. The specimen may either be double-end rammed with three blows of a seven-pound weight or rammed to the same mould hardness as the moulds in the shop. Whichever method be used, the practice must be standardized and maintained at all times. The specimen should be placed between ceramic discs, to insure proper contact, and the specimen and discs placed in the testing apparatus. In most control applications, a soaking time of 12 min. is used; at the lower temperatures, this is insufficient time to bring the specimen to uniform temperature throughout its mass, but this fact may be ignored for the sake of speed. At the end of the twelve-minute soaking period, the specimen should be preloaded with a load of from one to three pounds and the hot-deformation recorder turned on and adjusted. The compression pump of the apparatus should then be started and the specimen loaded to breaking point. The strength and deformation values can then be taken from the stress/strain diagram.

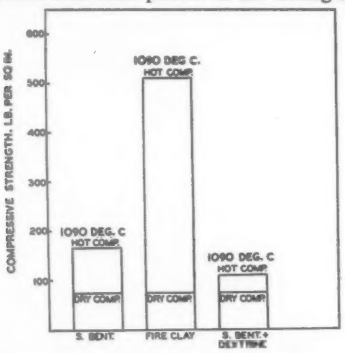


FIG. 5.—*Hot-compression strength for sands differently compounded but having the same dry-compression strength.*

The hot-compression-strength of a sand mix may be raised by an increase in clay, the substitution of sodium bentonites for calcium bentonites, an increase in fines, or through the addition of a number of commercial organic binders. The control of erosion-type scabs solely on the basis of dry-compression-strength testing is dangerous as this does not give an accurate indication of the bond at high temperatures. Fig. 5 illustrates the variation in hot-compression strength that may occur between sands having the same dry-strength. Each binder is affected differently by temperature, and while a number of mixes may have the same "green" or dry properties, the strength of each will vary at high temperatures with the changes in the condition of the binder.

Expansion Scabs

During the pouring operation, the walls of a mould cavity are brought to a high temperature very quickly, but due to the insulating properties of the sand, there is a severe thermal gradient across the first layers of sand. The surface layer increases in temperature at a greater rate than the sand immediately behind it. The silica grains expand rapidly and build up severe compressive stresses in this thin layer, if the grains cannot rearrange themselves to relieve the stresses. If there be no relief, the surface layer will rupture. One form of rupture produces the expansion-type (or type-A) scab. This scab is a defect with thin protruding edges, raised above the casting surface and separated from it by a layer of displaced sand. This type of scab may be prised or chipped off, leaving a depression in the casting surface.

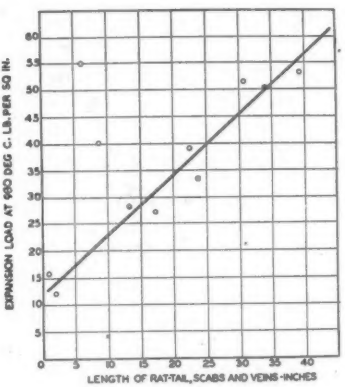


FIG. 6.—*Correlation between expansion/load test results and total length of scab defects in castings.*

When a specimen is loaded in compression at elevated temperature, it deforms before breaking, indicating that a rearrangement in grain orientation has taken place. This ability of the sand to change in packing explains how the sand grains in a mould can expand without producing compressive stresses strong enough to rupture the mould surface. This capacity for rearrangement or hot deformation, is measured with a hot-deformation recorder as shown in Fig. 3.

Expansion/Load Test

The expansion/load test is a new testing procedure, providing a relatively simple, short method for detecting scabbing tendencies; it may be carried out within ten minutes. The principle is simple—to determine the magnitude of the compressive stress to which a sand is subjected by its own expansion. The compressive stress is determined by measuring the load which has to be applied to a sand specimen in a furnace to prevent it from expanding. This test is run in a dilatometer furnace equipped with a loading system as shown in Fig. 2. A $1\frac{1}{8}$-in. dia. 2-in. long specimen is placed in the furnace at 980 deg. C.—for grey-iron sands—and a small pre-load is applied to ensure good contact between the specimen, end discs and loading posts. This pre-load should be kept as small as possible, for example, $\frac{1}{2}$ lb. per sq. in. A dial indicator is then placed against the dirt pan of the lower loading-post and adjusted to zero. On units equipped with a hot-deformation recorder, a base line should be drawn on the recorder-drum paper and the sensing device adjusted so that the stylus rests on the line. When the adjustments have been completed, a stop-watch is started and sufficient load

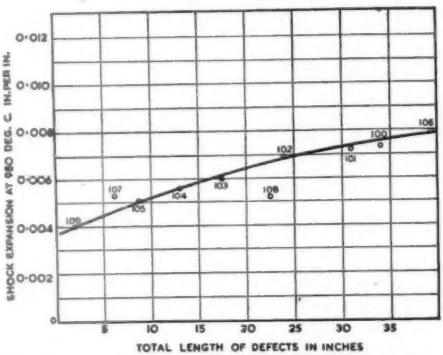


FIG. 7.—*Shock/expansion test results at* 1 *lb. per sq. in. load, correlated with the magnitude of defects of grey-iron castings.*

is applied to prevent the specimen from expanding lengthwise—the length of the specimen being maintained within 0.0005 in. The relief valve on new models of the Thermolab type of apparatus should be used to alter the load applied, or on older units which are equipped with a hand crank, the load may be adjusted with the crank. The time and the load required to hold the length of the specimen constant should be recorded every 15 sec. up to five min. and the average load calculated.

Results

Fig. 6 shows the correlation between the test data and length of defect for a number of sands used in the January, 1956, work of the AFS 8-J committee*. The length of defect was used in this graph, because scab-area measurements are time-consuming and cannot be plotted on the same graph as the rat-tail measurements as they are expressed in other units. When the scab defects in castings are measured along their long axis and expressed as length of scab, they can be plotted on the same ordinates with rat-tails and buckles. The two sands that do not fall close to the line in Fig. 6 are both veining sands. This should be expected, as veining in moulding sand is undoubtedly influenced more by shrinkage of the sand, on drying at relatively low temperatures, than by high-temperature expansion. The correlation shown in Fig. 6 is good but the test is new and more work will be required to determine how the test will serve with sands that are not used in grey-iron casting. Test temperatures other than 980 deg. C. may be required for sands used to cast steel or sands used for non-ferrous metals.

Advantages

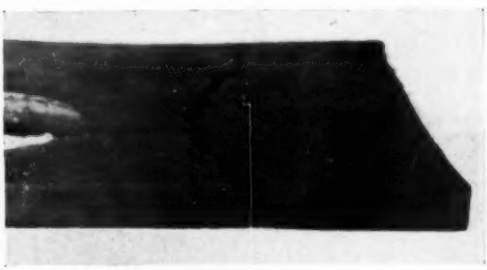
One of the principal advantages of this test is the fact that it appears to differentiate between good sands and those sands which produce rat-tails and type-A scabs. Since these defects are all expansion-type defects, a well-designed expansion test should pick out the good sands from those which produce any of these defects. This seems to be the case with the expansion/load method, and there must be something inherent in the procedure that makes it successful. In the test, sufficient load is applied to restrain the expansion in one direction, the load applied being that required to produce the deformation necessary to cancel out expansion in this direction. Therefore, the load is a function of the hot-deformation property as well as a function of the expansion.

The load required to maintain a constant length increases very rapidly when the specimen is being heated and falls off again within five minutes. This suggests that the specimen is passing through the temperature range where the expansion is greater than the hot deformation. It is in this range that higher additional loads are required to produce enough hot deformation to cancel the expansion.

Shock-expansion Test

A study of test data carried out by AFS committee 8-J, covering ten different sands which were used to cast grey-iron test castings under closely

FIG. 8.—*Example of a very severe rat-tail defect.*



* Its full title is: "Physical Properties of Ironfoundry Moulding Material at Elevated Temperatures Committee".

controlled conditions shows that the shock-expansion test applying a 1-lb. per sq. in. load may be used to predict whether or not a sand will cause a mould-fracture defect such as a rat-tail or scab on a grey-iron casting. The magnitude of the defect may also be predicted for a given casting. The greater the shock expansion under a load, expressed in inches of expansion per linear inch of specimen, the greater the total length of defect. A graphical presentation of this correlation is shown in Fig. 7—an exceptionally good example.

The shock-expansion test was made by ramming the standard 1½-in. by 2-in. sand specimen to a green hardness identical to that which the mould was rammed for each particular sand. A variable-height drop of the 1½-in. rammer weight was employed to secure the required hardness. (Specimens for all elevated temperature tests should be rammed to the same degree as that employed in the foundry when casting quality is being correlated with laboratory elevated-temperature test data.) The "green" rammed specimens were placed in a dilatometer furnace at 980 deg. C. and loaded with a 1 lb. per sq. in. pre-load. This was maintained by means of a hand pump and the expansion was recorded as a function of time, on a deformation recorder as shown in Fig. 3. The expansion was measured at the 22½-sec. mark on the paper wound on the recorder drum. The magnitude of mould-surface fracture was again expressed in terms of total length of defects by measuring the total length of rat-tails, veins, type-A scabs and buckles (the length of scab being measured as the longest dimension).

Rat-tails and Buckles

Rat-tail defects in castings, shown in Fig. 8, and buckles, shown in Fig. 9, are also expansion-type defects that can be subjected to close control as a result of high-temperature testing. The AFS committee (8-J) found good correlation between rat-tail defects and a hot-compression-strength/confined-expansion relationship.[1] A sand showing a high confined-expansion at 1,370 deg. C. and a high hot-compressive-strength at 540 deg. C. will tend to produce rat-tails or buckles. Fig. 10 shows the relationship between these properties and rat-tail defects in grey-iron castings made with the "rat-tail" pattern developed by the AFS committee—this pattern produces castings in the form of a plate 11-in. long, 9-in. wide and ½-in. thick.

FIG. 9.—*Casting cut to show a buckle defect.*

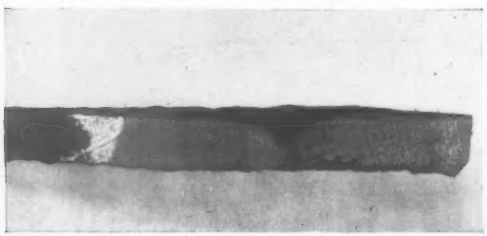


Fig. 10 may be used as a rough reference for applications similar to the rat-tail casting. The sand can be tested for hot-compressive-strength at 540 deg. C. and confined-expansion at 1,370 deg. C. and the value plotted on this graph to determine whether or not the sand has rat-tailing tendencies. If the test data fall close to the line dividing the rat-tail and non-rat-tail zones, the sand mix should be considered as liable to produce defects and the composition should be changed to improve the mix.

Test Details

The hot-compressive-strength test is run in apparatus similar to that described earlier, using a 1½-in. dia., 2-in. long specimen. The specimen

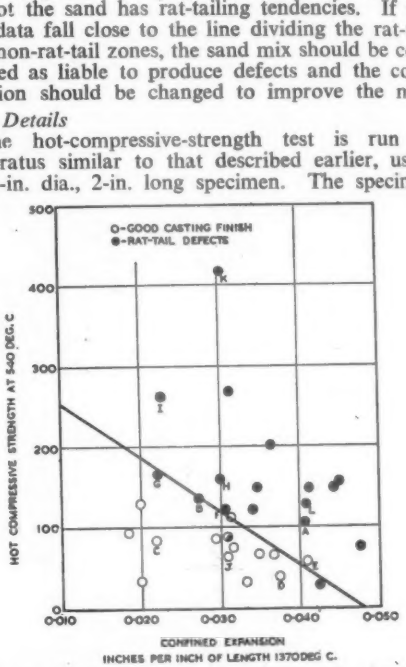


FIG. 10.—*Classification of sands on the basis of hot-compressive strength and confined-expansion relationships.*

is "soaked" at 540 deg. C. for 12 min. before load is applied. Fig. 10 was constructed using test data obtained with specimens rammed three times with a 7-lb. load. If a new graph is required for a different type of casting, it would be best to use sand specimens rammed to the same hardness as that employed in the moulds. The confined-expansion test is made on the same size of specimen but with a ½-in. dia. hole through its centre the purpose of which is to ensure that it reaches a uniform temperature quickly. The specimen is rammed in a fused-quartz tube so that during heating the radial expansion is restrained and the sand, is only free to expand axially. As quartz softens at 1,370 deg. C. the micrometer frame in the hot zone of the furnace must be supported from below to prevent warpage.

It should be borne in mind that the graph (Fig. 10) was constructed on the basis of a fixed size and shape of grey-iron casting. For other metals, other patterns, or any other conditions, the relationship between the physical properties and

the defect may be somewhat altered. However, a foundryman can soon develop his own graph for his own particular circumstances using Fig. 10 as a guide only.

Remedies for Rat-tailing

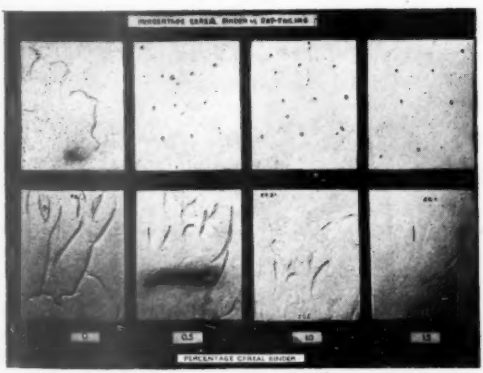
There are a number of methods for controlling rat-tail defects in castings. Moisture control is important, as moisture is an indirect cause, since it may increase the density of the sand, thereby increasing the expansion and hot-compression values. Controlling the mould hardness is also important, as the degree of rat-tailing increases with increasing mould-hardness. Ramming soft is not the best solution for rat-tailing as it leads to cuts and washes, but the mould hardness must be kept to a specific range, as part of good moulding practice. When the moisture and mould hardness are controlled, rat-tails and buckles can be reduced, or eliminated, through the use of cushioning agents such as wood-flour, cereal, or similar cellulose materials. Figs. 11 and 12 illustrate the effect of these organic materials on sands having particularly severe tendency to produce rat-tails.

Cuts and Washes

In moulding sands, cuts and washes can be produced by the presence of excess moisture, as the escaping steam agitates the metal and this promotes erosion of the mould. However, if one assumes that intelligent moisture-control is practised, the principal cause of cuts and washes is deficiency of bond in the sand. The sand bond must be high enough to withstand the impingement of the metal and the flow of metal across its surface. If the bond between the sand grains fails, the sand will be swept away, leaving a defect similar to that shown in Fig. 13.

The control of cuts and washes is, therefore, simply a control of the percentage of binder so that the sand is strong enough to withstand the erosion of the metal throughout the temperature range to which it is subjected. A series of hot compression-strength tests, from 260 to 1370 deg. C.

FIG. 11.—*Effect of cereal additions to a sand which is prone to produce rat-tail defects.*



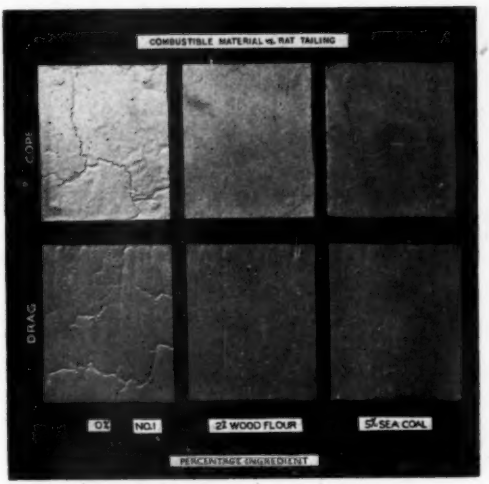


FIG. 12.—*Effect of wood-flour and coal-dust additions to a sand to reduce the tendency to produce rat-tails.*

should be run as a control and the binder content adjusted to maintain the strength at the desired values. The green-compression, air-hardened and dry compression-strength should also be measured, as failure of the sand at temperatures below 260 deg. C. will also produce these defects. If a sand be low in refractoriness, it may have a low hot-strength at 1,090 to 1,370 deg. C. without, necessarily, failure of the sand surface taking place. This would occur if the surface became plastic; in this case, the sand would "give," but the sand grains would not be washed away. This could lead to a change in casting dimension, but would not produce cuts and washes, as such. In working with a sand of low-refractoriness, it is, therefore, important to test for hot-deformation, as well as hot-strength, throughout the temperature range. This is easily accomplished, through the use of a proper deformation recorder, as the deformation can be measured simultaneously with the hot-compression-strength.

Veining

In this discussion of veining, the Authors' confine the subject to those "veins" or fins that are formed on a casting by the solidification of metal in the cracks developed in cores after the metal is poured. The veining caused in dry-sand moulds—as a result of cracking during the drying operation—is not a high-temperature phenomena, and because of this, its cure should not be sought through the medium of high-temperature testing. Veining in a core, as shown in Fig. 14, usually appears at an angle or other hot-spot in the core, where the metal heats the sand from more than one direction. It would appear that veining is caused by expansion, or contraction, in the surface layers of the core, where the sand does not have sufficient hot-plasticity

to take care of the stresses generated. As the defects usually appear at the point of the greatest thermal shock, the rate of expansion with increasing temperature may be directly involved.

A number of tests have been developed the results from which show correlation with veining but, at the present time, these do not include expansion effects. The most promising tests, so far are hot-strength, hot-deformation rate and "green" hardness[2]. Fig. 15 illustrates this correlation between hot-compression strength at 1,370 deg. C. with a five-minute soaking period and the degree of veining in a test casting devised by committee 8-J for assessing the tendency to produce veining of a limited number of core mixes. For this particular grey-iron casting and core, mixes having a hot-compression strength of over 40 lb. per sq. in. at 1,370 deg. C., with a five-minute soaking period, produce veining, whereas those mixes having a lower compression-strength produce no veining. At 1,370 deg. C. the hot-compression-strength test seems to indicate the refractoriness of the sand. Sands with low hot-strength tend to become plastic, but there may be exceptions to this.

Test Details

The hot-strength and hot-deformation tests are carried out in a Thermolab equipped with an "own-atmosphere-hood" post. The position of a specimen in the hood being illustrated in Fig. 16. The specimen is soaked at temperature within the hood before loading to the breaking point. As there is always some chimney effect in a Thermolab furnace, it is necessary to use this hood to achieve a reducing atmosphere similar to that encountered in a mould.

Veining is a defect that seems to be especially pronounced from a mould of hard, brittle sand; high moisture contents and hard ramming promote veining, as also does high pouring-temperature. The condition can often be ameliorated through

FIG. 13.—*"Cut" or "wash" defect due to low hot-compression strength.*

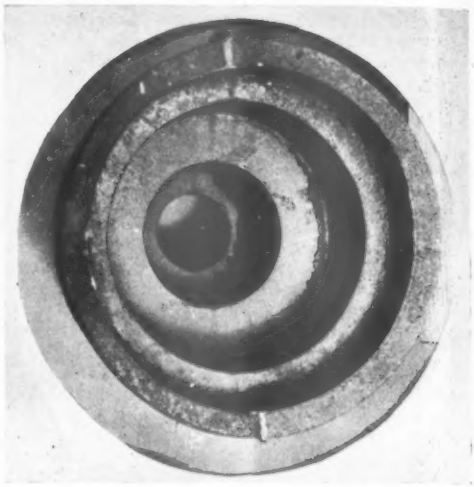


FIG. 14.—*Veining defects in a core, which can be seen in the two bottom angles of the casting.*

the addition to the sand of fluxing agents that will reduce the hot strength at 1,370 deg. C. and increase the tendency to hot deformation—iron oxide is known to be an excellent additive for eliminating this defect. Impure sands have less tendency to produce veining, but the base sand selected should not contain too much silt or clay, as this will require additional binder and the latter may raise the cost of the casting more than the additional cost resulting from an occasional defect due to this cause.

The hot compression-strength test at 1,370 deg. C. should be used as a test of veining tendencies when selecting core materials and the specimen should be tested using a five-minute soak in an "own-atmosphere-hood" post. The rate of hot deformation can also be used as a guide: Veining in green moulding sand is still difficult to predict, but it may be possible to correlate this defect with expansion load, or some other relatively new test. However, at the present time, there is no test recommended for the control of the defect.

Specimen Heating

The elevated-temperature tests discussed in the preceding sections were conducted in a furnace heated by a number of silicon-carbide elements. The specimens were brought to temperature by radiant heat from the hot furnace walls and from the elements themselves. With this method of high-temperature testing, the rammed-sand specimen absorbs heat in the same manner as it would at the face of a mould or core. The outer layer of the sand in the furnace and in the mould is heated from the surface inwards.

The good correlation shown in this Paper between casting surface defects and high-temperature test data indicates that the radiant-heating

method parallels the conditions found in a mould. The Authors have been experimenting with high-frequency heating of sand specimens for a number of years, but the only advantage apparent in this method, at the present time, is in the rate of heating. The thermal gradient produced in the specimen is the reverse of that in the mould, as the specimen surface is cooler than the interior. Research on this method of heating is being continued, but at the present time, radiant heating is the most practical and economical method for general research and control heating.

Test Atmosphere

The atmosphere surrounding a mould or core surface affects the hot properties of a sand, particularly that of a core bonded with an organic binder which burns readily. A hooded post is recommended for the testing of all cores containing organic binders in order to prevent rapid oxidation

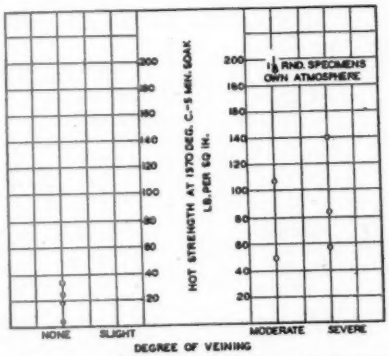


FIG. 15.—*Correlation between hot-compression strength at* 1,370 *deg. C. in "own atmosphere" and the degree of veining of a casting.*

of the corebinder. The hood (as shown in the section on veining) traps the gases given off by the sand specimen and the specimen is therefore tested in an atmosphere formed of its own gases. This simulates mould conditions closely with the exception that gases arising from the molten metal are absent, but these are much smaller in volume than gases produced by the mould or core surface.

Summary

Casting defects produced by the failure of the mould surface include cuts, washes, type-B (or erosion-type scabs), rat-tails, buckles and type-A (or expansion-type scabs). These defects are linked to the elevated-temperature properties of the sands and may be predicted, and thereby controlled, by means of high-temperature testing. The basic unit required to measure the hot properties of a sand is a dilatometer furnace using, preferably, silicon-carbide heating elements and equipped with a loading system for measuring the hot-compression strength. Hot strength of a sand compact is determined by loading the specimen, while it is at high temperature, until it collapses. Another important property is hot deformation ; this is measured with a unit which continuously records the load and decrease in length of the specimen as it is loaded at elevated temperatures. The recorder plots the stress/strain diagram during the loading operation and from this diagram the amount of hot deformation may be determined at any load. A timing device makes it possible to measure the rate of loading, or rate of hot deformation. The data secured can be used to compute factors such as plasticity or brittleness for the sand mix.

Expansion of a sand is measured with a quartz-frame expansion micrometer, the end of the frame supporting the sand specimen being heated in a dilatometer furnace. The sand specimen may be free to expand in all directions, or it may be confined in a quartz tube to restrict radial expansion. Expansion under load, or the load created by the expansion, may be determined by using the hot-deformation recorder (Fig. 3), or by placing a dial indicator under the dirt pan of the dilatometer lower-post assembly.

Cuts, washes and type-B scabs are erosion defects that form an integral part of a casting. These defects can be predicted and controlled on the basis of the hot-compression strength and hot deformation of the sand. They may be eliminated by increasing the hot-compression strength and the hot deformation through the temperature range to which the sand is exposed. This may be accomplished through the use of clay or other high-temperature bonding materials.

Rat-tails and buckles are expansion type defects appearing as a line or area on the casting surface at a different level than the main, adjacent parts of the casting surface. These defects may be predicted and controlled on the basis of the hot-compression strength at 540 deg. C. and the confined expansion at 1,370 deg. C. If the hot strength of a sand is high and the expansion relatively low, the sand may not produce these defects, but if both the hot-compression strength and the expansion are high, the sand will have a definite tendency to form rat-tails and buckles. If the sand is low in both hot strength and expansion, it will be free of rat-tails and buckles. Type-A scabs are also expansion defects and, like rat-tails and buckles, are caused by mould or core surface instability.

Rat-tails, buckles and type-A scabs are all caused by the sand's inability to accommodate, or absorb, the expansion of the sand grains. If there is insufficient hot deformation (which is the ability of the sand to change in packing under load), the mould surface will rupture. Rat-tails, buckles and type-A scabs may be reduced, or eliminated, through the use of cushioning agents, such as wood-flour, cereal, grain hull, pitch, or coal-dust. A recent test has been developed that shows good correlation with rat-tails and type-A scabs. This is the expansion/load test at 980 deg. C. The test procedure consists of shock-heating a specimen from room temperature to 980 deg. C. while applying enough load to maintain the specimen at a constant length. This determines the load necessary to overcome the

High-temperature Testing of Sands

expansion of a sand and the value reported is the average load necessary to maintain constant length during the first five minutes of test. The greater the expansion load, the greater the tendency to produce rat-tails, buckles and type-A scab defects. This is one of the simplest tests developed to date, and has the advantage that it may be used to differentiate between good sands and sands that might produce any of the common expansion defects.

Another very simple test for determining the scabbing, buckling and rat-tailing of moulding sands is the expansion-under-load test. In this test, the expansion of a sand specimen, rammed to the same hardness as moulds in a foundry, is placed between the posts of the dilatometer; furnace temperature is kept at 980 deg. C. and a load of one lb. per sq. in. is maintained on the specimen. The expansion is read on a dial indicator placed under the dirt pan of the lower post, or on a hot-deformation recorder. The expansion reading at 22½ sec. correlates with the quality of the sand in regard to its resistance to mould-wall fracture defects.

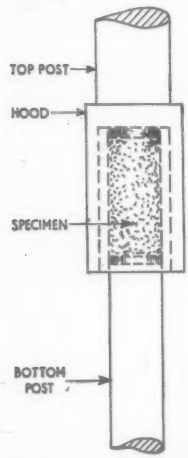


FIG. 16.—*Sketch of "own-atmosphere-hood" post, with a specimen in the test position.*

Veining defects in the cored surfaces of castings can be predicted using an own-atmosphere, hot-compression-strength test at 1,370 deg. C. using a five-min. soak. The higher the hot strength under these conditions, the greater the tendency of the core sand to produce veining defects. Further research is shortly to be undertaken to determine the relationship between hot deformation and veining defects.

On the basis of the correlation that has been established between surface defects and elevated-temperature testing, it is apparent that these tests should play an important part in any complete sand-control programme. The individual foundryman should develop his own practical limits for these "hot" properties on the basis of individual experience and the graphs reported here should be used only as guides to indicate the direction in which corrections should be made.

REFERENCES.

1 "Causes of Rat-tail Casting Defects—Final Report of AFS Committee on Physical Properties of Ironfoundry Moulding Materials at Elevated Temperatures." AFS *Transactions*, **57**, 526–534 (1949).

2 "Veining Tendencies of Cores—Progress Report by AFS Sand Division Committee 8-J." AFS *Transactions*, **61**, 150–155 (1953).

Linking of Turbine Activities

Further interchange of suitable work and pooling of resources through the complete linking of Parsons Marine Turbine Company, Limited, and Richardsons Westgarth & Company, Limited, should achieve an important increase in output to meet the growing demand for land and marine turbines. This statement accompanies an offer by Richardsons Westgarth of 11 5s. units in exchange for each two £1 shares in Parsons Marine Turbine Company.

The offer is subject to acceptance by the holders of 90 per cent. of the Parsons Marine shares or such lower percentage (not less than 75 per cent.) as Richardsons Westgarth may be willing to accept. The directors of Parsons Marine are willing to exchange their own shares on this basis and intend to recommend all shareholders in the company to accept.

The works of one of the Richardsons Westgarth group of companies, the North Eastern Marine Engineering Company, Limited, is adjacent to the Turbinia works of Parsons Marine Turbine Company, at Wallsend-on-Tyne. Parsons Marine Turbine and Richardsons Westgarth (Hartlepool), Limited, have for some time been associated on sub-contract work exchange between the two undertakings

Last month Parsons Marine shareholders were informed that the directors had been approached for fusion with another company by an exchange of shares. Parsons Marine has £396,150 in issue, all in £1 shares.

Raw Material Prices Fall Again

Following the sharp rise in basic materials prices in the two months after the closing of the Suez Canal, there has again been a slight drop. The Board of Trade index for February (June 30, 1949=100) was 158.7, 1.3 per cent. lower than in January. During November and December the index rose by over 3.5 per cent.

The February decline is mainly accounted for by a drop in the prices of copper (down 8 per cent.), raw rubber (down 9.7 per cent.), linseed oil, jute, tungsten ore, lead, and zinc. Among the few commodities which rose in price were imported steel scrap and manganese ore. Reductions in the prices of non-ferrous metal items were the main cause of drops of 0.7 and 1.9 per cent. respectively, in the indices for mechanical engineering and electrical engineering materials. Wholesale prices for manufactured products were also stable, the index for February being 138.1, against 138 in January, and 134.1 in the same month a year ago.

Improvements in cover for exporters

Improvements in insurance cover for UK exporters have been announced by the Export Credits Guarantee Department, and from April 1, a completely revised form of cover against payment risks will be available to exporters of goods sold on terms of payment up to two years credit. The principal changes are:—(1) Once shipment has been made ECGD pays 95 per cent (hitherto 90 per cent.) of all specified losses outside the control of buyer or seller. (2) Claims arising out of "transfer" or "political" risks (*e.g.*, blockage of exchange by buyer's government) will be settled after four months (hitherto six); claims due to default on goods accepted will be paid after six months (hitherto 12). (3) For the first time limited cover will be given on default by the buyer *before* acceptance of the goods. Under this heading the exporter must bear a first loss of £20 on every £100 of invoice price: ECGD then bears 85 per cent. of any loss within the next £40.

Clean Air Conference*

Institution of Mechanical Engineers discuss Wide Implications at London Meeting

The Report of the Committee on Air Pollution under the chairmanship of Sir Hugh Beaver has now led to the Clean Air Act of 1956. This Act does not contain precise details as to how clean air is to be achieved, but instead deals rather with fundamental principles which must be met. No doubt Regulations will be made under the Act in due course which will lay down specific technical requirements as these become progressively clearer and as scientific and technical information provides methods of securing clean air in industrial areas. [This should be clearly understood by founders, because it follows that as yet no apparatus can properly be defined as "fulfilling the requirements of the Clean Air Act."—Editor].

The Clean Air Act affects every producer of atmospheric pollutants and so, to some extent, affects most industries in this country. It also affects nearly every householder because the ordinary domestic fire makes no small contribution to the atmospheric pollution in Great Britain. Many technical problems will have to be solved if the maximum benefit is to be obtained from the operation of the legislation, but quite apart from technical and scientific aspects of the matter, large numbers of people will have to accept responsibility for the state of the atmosphere. In the initial stages it may well be that the one factor that will determine progress will, in fact, be the speed with which men and women recognize the social responsibilities which lie behind so many of their activities.

Onus on Engineers

The Institution of Mechanical Engineers realized that mechanical engineers were deeply implicated in the matter if only because about 200 million tons of coal are used annually in this country. This represents in total a major source of atmospheric pollution which is often under the control of engineers. The engineer could, therefore, make a very great contribution to the Clean Air Act and it was for this reason that the Institution sponsored a Conference on the mechanical engineers' contribution to clean air. This Conference, held in London last month, attracted the active support of many sister institutions and learned societies. Because this was the first conference to be held on this subject, it was specifically arranged to cover the widest possible industrial field and it included sixteen papers written by acknowledged experts. This large number of papers gave little time for authors to explain their work and resulted in a somewhat restricted discussion, but the proceedings of the Conference will undoubtedly provide a mass of information which will form an excellent starting point for any engineer who needs to study particular problems.

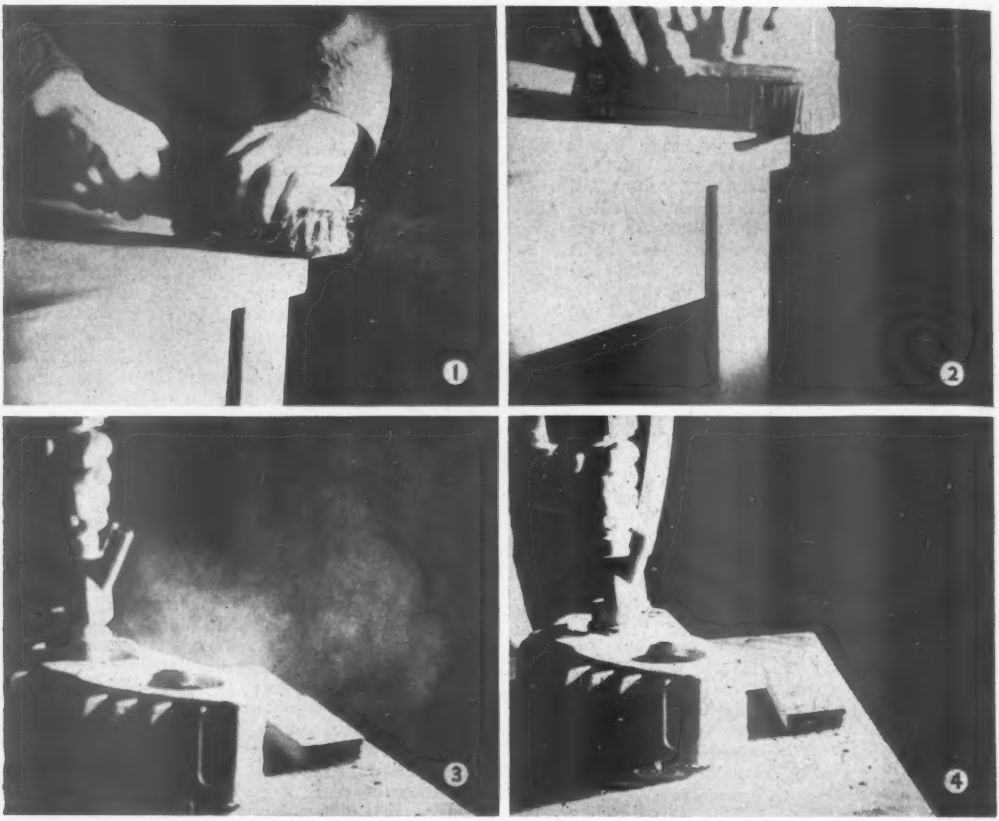
Costs Involved

Clean air will not be attained cheaply and some very interesting costs were suggested at the Conference. The Beaver Committee estimated that the direct cost of air pollution was of the order of £250 million per annum to which might be added the further sum of £25 million per annum for the loss due to incomplete combustion of the fuel. It was pointed out at the Conference that the oxides of sulphur represent a source of pollution which cannot be eliminated in the present state of knowledge, so that the immediate practicable saving might be of the order of £100 to £150 million per year. To save this will involve a fairly high capital expenditure. It was suggested that in the best conditions on continuously-operating units, the dust-control equipment would cost about £1 per ton of coal burnt per annum. This cost would be expected to rise with special difficulties and may be as high as £4 per ton per annum. Taking an estimated mean figure of £3 per ton per annum, this gives a total cost of about £550 million to which must be added the cost of controlling pollutants from industrial processes other than the combustion of fuel. This extra cost was put at £100 million, giving a final estimated figure of £625 million. It was supposed that this sum would be spent over a period of about 15 years giving an expenditure of £40 million per annum, which was stated to be about 3 per cent. of the net annual domestic capital expenditure in 1955. Sir Ewart Smith remarked that "the cost of implementing the Clean Air Act though burdensome cannot be regarded as intolerable." It is evident, however, that determination to carry out the requirements is quite indispensable and that a sustained effort will have to be made.

The Clean Air Act was designed to reduce smoke and dust and does not attempt to govern the emission of gaseous pollutants such as sulphur dioxide. This represents a practical approach because it is not at present feasible to control these pollutants. One paper only discussed flue-gas-washing equipment for the removal of sulphur dioxide and it is clear that a good deal of research work still remains to be done before this objectionable gas can be removed from the products of combustion before they leave a chimney stack and pass to atmosphere.

The removal of dust and smoke from stack gases also presents many difficulties, but considerable improvements can be made in many cases on existing practice. So far as smoke is concerned, the main need is for better combustion. New furnaces as fitted should now be smokeless. A particularly interesting example of the best possible approach to the problem was given in the paper on the ceramics industry in which Dr. Green discussed the change from the old coal-fired "bottle ovens" to the modern continuous kilns. The first tunnel kiln was built in Stoke-on-Trent in 1912 and

* The arrangements for this Conference were reported in the JOURNAL, January 10, p. 34.



FIGS. 1 *and* 2.—*Hand wire-brush being used for removal of rust from a steel plate. In* FIG. 1, *a cloud of dust is generated and particles of rust are loosened; when the brush is fitted with a low-volume high-velocity exhaust system as in* FIG. 2, *the main dust-cloud is under control, only a small quantity of heavy dust (at the edge) can be seen falling to the floor.*

FIGS. 3 *and* 4.—*Three-inch-dia. power-operated cone grinding wheel in use on a grey-iron cylinder-head. The effect of installing an exhaust system can be clearly seen by comparing the illustrations,* FIG. 3 *showing the dust cloud when exhaust was not applied.*

was fired by producer gas. By 1939, there were 66 gas-fired tunnel kilns and now there are over 300. To-day, there are about 150 electrically-fired kilns in the Stoke-on-Trent area. In 1939 there were 1,500 coal-fired bottle kilns and now there are less than 500. This has resulted in a decrease in the consumption of solid fuel from one million tons yearly in 1939 to 400,000 tons per year at the present time. The process is economically sound and the atmospheric pollution in the area has fallen from 0.98 mg. per cub. metre in 1933/36 to less than 0.50 mg. per cub. metre at the present day. Wherever it is possible there can be no shadow of doubt that the way to get clean air is to stop pollution.

Dust Problems

Dust presents a different problem because while some of the suspended matter in black smoke can be burnt, much industrial dust is not combustible. The dust may appear as fly ash from combustion processes. This dust may be separated in electrostatic precipitators and the stack height increased so that no visible dust escapes from the chimney top. Electrostatic precipitators are, however, expensive and stacks become more expensive as heights are increased (suggested heights being of the order of 300 ft.). One of the worst problems is the dust emitted from pulverized-fuel-fired water-tube boilers, but the new cyclone method of firing large boilers may offer a solution, as much of the dust is collected in the slag and the amount of dust going to the stack may be reduced to one eighth of that in the normal pulverized-fuel-fired system. This is another excellent example of the correct method of approach to the whole problem. Dust should always be eliminated if possible before

large capital sums are spent on filters to control it. It may not always be possible, but it is better and cheaper to stop making dust than it is to control it.

Dust may also appear as a result of industrial processes and this is of particular interest to foundrymen. One paper dealt with dust and fume problems resulting from the operation of furnaces in the iron and steel industry. Gas-cleaning plant is normally fitted to blast furnaces and a very high standard is attained. Open-hearth furnaces produce large amounts of fume especially if the oxygen lance is used and the cleaning of the effluent before discharge from the stack is a very expensive matter. The Bessemer process offers a still more difficult problem, as the fume is difficult to collect for passing to a filter plant. Arc furnaces can be fitted with hoods, but the economic problem of filtering the effluent is formidable. Cupolas can be fitted with dust-control equipment, but until the required standard is known, no estimate can be made of the cost. The collection of the coarser sizes of effluent is relatively easy, but as the particle size of the dust decreases, the difficulties of filtering it and the cost of the equipment both increase rapidly. So far as small heat-treatment furnaces are concerned, it was pointed out at the Conference that the use of gaseous fuel eliminated smoke while good combustion methods very nearly did the same when solid-fuel firing was employed. There is reported to be no metallurgical justification for smoky flames.

Foundry Atmospheres

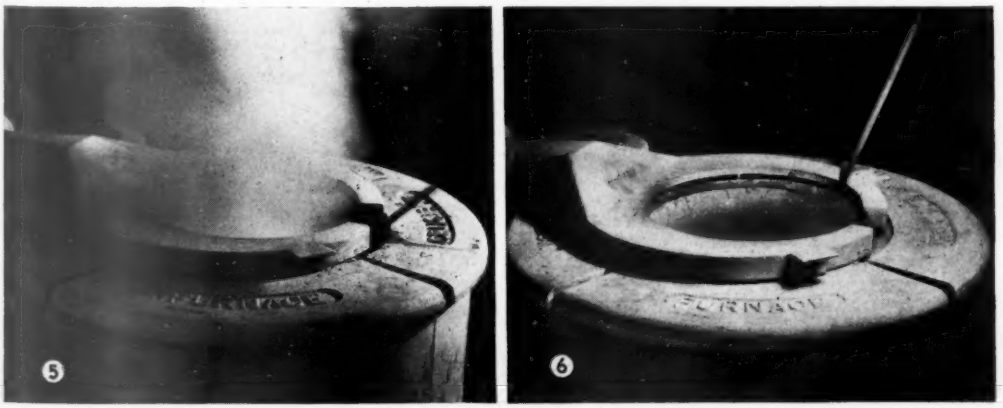
The paper on "Foundry Atmospheres" summarized the work of the last decade and ended with certain new applications of the low-volume high-velocity exhaust system. Much of this work has already been published in this JOURNAL, in the interest of clean air inside the foundry. This is, however, a prerequisite of clean air outside, because unless dust and fumes are controlled at their source they cannot be filtered before escaping from the building. It was interesting to notice that only this paper and the paper on air pollution in mines dealt specifically with the particle sizes which are invisible in ordinary conditions of lighting, but are known to be dangerous to health.

Although it is always best to eliminate dust, fume and smoke there are many processes where this cannot be done and the control methods must then be used. In this connection, there was a very interesting paper which summarized the existing information on mechanical grit- and dust-collectors and concluded with some notes on operation and maintenance.

Other Subjects

A group of four papers dealt with the fumes from road transport vehicles. These papers might be of direct interest to foundrymen who operate internal-combustion engines to drive trucks inside the foundry quite apart from road transport which concerns the public generally. The paper on "Ships in Port" might not perhaps be of particular interest to foundrymen and the paper on "Elimination of Smoke from Locomotives" was another which has little immediate interest to readers of this JOURNAL, although it does indicate quite clearly that the best way to control the smoke from steam locomotives is in fact to use electric power! Here again stress was laid on the elimination of pollution at the source rather than on efforts to control it afterwards. A further paper emphasized the need for instruments and automatic control and although this paper dealt primarily with methods of combustion, its general implication—that instruments and automatic control lead to less pollution—is true enough in most industrial processes. The Conference ended with a paper entitled "Education and Training of Boiler

FIGS. 5 *and* 6.—*Operation of a low-volume high-velocity exhaust system on a bale-out furnace effects almost* 100 *per cent. removal of fume (in* FIG. 6) *during the application of flux to molten aluminium: the fume is removed through a periferal duct. Note the contrast to* FIG. 5, *where the system is not working.*



Clean Air Conference

Operators." Once again, the paper was not of direct interest to foundrymen, but it did indicate schemes of training and special courses organized by technical colleges, the National Coal Board, the Central Electricity Authority and the National Industrial Fuel Efficiency Service which were designed to produce more skilful boiler operators so that the more efficient working of industrial boilers and furnaces might result in the elimination of the emission of smoke from factory chimneys and also result in a more profitable use of the fuel. Probably far too little thought is given even now to the training of operators and there can be no doubt that industry as a whole would profit considerably if similar schemes could be devised and operated in order to train process workers of all kinds.

Films

Two films were shown. The first entitled "Guilty Chimneys" is distributed by the Gas Council Film Library and deals with the effects of atmospheric pollution on health and on buildings. This film is suitable for general-public audiences and was quite clearly made in an effort to harness public opinion. The second film was entitled "The Low-volume High-velocity Exhaust System"; it was by W. B. Lawrie and summarized the early work, much of which has already been published in this JOURNAL, and ended by illustrating three new applications of the low-volume high-velocity exhaust systems which are applicable to foundry operations. It showed the control of dust within the respirable size range from the pneumatic chisel, the portable grinder, the portable surface-grinder, the swing-frame grinder, the three-inch diameter cone grinding wheel, the one-inch diameter flexible-shaft-driven "mounted point," the portable radial wire-brush, the portable surface wire-brush, the hand wire-brush and the sanding disc. Figs. 1 to 6 give some indication of the results obtained in these latest applications of the principle.

There is still plenty of room for further conferences and discussions on this very complicated subject and probably the main necessity is that particular industries should consider the matter in the context of their own particular needs. This first conference, however, has provided a broad general survey which cannot fail to interest the technical men whose duty it will be to meet the Clean Air Act and if it awakens the conscience of the nation to the moral and social obligations underlying their industrial activities it will have been more than successful. Many difficult problems remain, but even now with goodwill and determination it is economically and technically possible to go a long way in the search for Blake's "Green and Pleasant Land."

Shipbuilders' £1,000,000 Reconstruction Plans

Construction of tankers of 65,000 tons, or even larger, will be possible when the project for the west shipyard of John Brown & Company (Clydebank), Limited, is completed. The scheme, which will cost more than £1,000,000, will involve, said Sir James McNeill, deputy chairman of the company, converting three berths into two berths.

In the past few years the company has spent very large sums in capital expenditure for berth conversions, for new gear cutting, new machine shops, a new sheet iron shop, and a new pipe shop. The amount involved was considerably in excess of the total profit earned over the same period. These were factors which many people did not realize, or just deliberately forgot.

Sir James was speaking at the recent launching of the Brahmaputra, a frigate for the Indian Navy. He welcomed the news that the industry was likely to get an additional 75,000 tons to 100,000 tons of steel this year. "If all things were normal" the industry would respond with a much larger contribution to the total tonnage production.

THE Federation of Light Metal Smelters reports that its members' average selling prices for February (calculated to the nearest 10s.) have been calculated as follows:—LM1, £167 10s. per ton; LM2, £168 10s.; LM4, £188 10s.; LM6, £205.

AN ORDER for 20 diesel railcars and 20 trailer cars has been given to the Gloucester Railway Carriage Company, Limited, by the British Transport Commission. This follows an order last September for 110 multiple unit diesel railcars and trailers for use in the Western Region.

Iron-ore Imports

Iron-ore imports in February, and the totals for the first two months of this year and last are shown below.

From	Month ended Feb. 28.	Two months ended February 28.	
	1957.	1956.	1957.
	Tons.	Tons.	Tons.
Sierra Leone	50,965	101,380	85,494
Canada	29,080	165,469	122,853
Other Commonwealth countries and Eire	2,275	3,129	3,225
Sweden	269,905	670,100	546,406
Norway	12,551	16,450	25,706
Western Germany	—	2,930	—
France	52,118	102,978	91,302
Portugal	5,081	14,705	16,801
Spain	58,803	135,839	161,180
Algeria	89,045	262,896	228,472
French West Africa	42,994	135,103	87,386
Tunisia	50,307	140,442	122,684
Northern Morocco	12,875	59,970	21,988
Southern Morocco	9,350	64,152	18,700
Liberia	23,230	38,560	58,520
Brazil	52,251	98,000	89,028
Other foreign countries	84,781	86,397	183,918
TOTAL	845,611	2,098,500	1,863,663

NRC EQUIPMENT CORPORATION, 160 Charlemont Street, Newton Highlands 61, Mass., has completed arrangements to licence the manufacture of its vacuum furnaces and related equipment to Wild-Barfield Electric Furnaces, Limited, in England. In addition, Wild-Barfield has been named exclusive resale agents in the United Kingdom for all the Corporation's high-vacuum components, packaged systems and other price listed items.

Notes from the Branches

South Africa

As a preliminary to the February paper, members of the South African branch of the Institute of British Foundrymen, visited the Randfontein Estates Gold Mining Company on February 21. In the morning, members had the choice of visiting either the reduction works or of going underground. At the mine, which is one of the largest in the world, 350,000 tons of gold ore are crushed each month. The first operation is the breaking of the gold-bearing rock underground, it is then hoisted to the surface to be collected by steam locomotives, each pulling eight 40-ton hoppers, for transportation to the mill for crushing. From the mill the crushed ore goes to the cyanide plant where the gold is extracted. Although mining operations are carried out over a wide area, all gold-bearing rock is sent to a central mill where the crushing and gold extraction is carried out.

Members visited the No. 3 North main vertical shaft which is a 22-ft. dia., circular, concrete-lined shaft; they were taken down to the 24th level, 3,263 ft. below the surface. It was noticed that hoists used were Markham steam hoists, one of which was used only for the hoisting of rock, and the other for hoisting and lowering of men and material; they are capable of developing 5,000 and 6,000 h.p. respectively, and at the time of installation, in 1936, each cost approximately £35,000. Rock is hoisted in seven-ton skips at the speed of 3,500 ft. per min. and men and material are raised and lowered at 3,000 ft. per min. To sink and equip the shaft to-day would cost approximately £65 per ft.; the total depth of the shaft is 3,478 ft.

After luncheon, all members visited the mine foundry, which employs 12 moulders, 5 apprentices, 3 patternmakers, 2 patternmaking apprentices and the usual administrative staff. Equipment includes a 2½ ton Heroult electric furnace from which 90 tons of steel castings are produced monthly; two 36-in. dia. cupolas, providing 50 tons of cast iron per month; and two oil-fired and two coke-fired pit furnaces, providing metal for five tons of non-ferrous castings per month. Various degrees of mechanization assist in the production of castings required in quantity. During the course of the visit, Mr. G. F. Alexander, branch president, thanked the mine management for permission to visit the property and for the courtesies shown to members.

Exchange Paper

On February 28, the official branch exchange paper to the Australian (Victoria) Branch 1956 Convention—"Castings in the Production of South African Gold" prepared jointly by Mr. H. G. Goyns and Mr. J. Steele, —was presented to the meeting by Mr. Steele. He began by saying that from the discovery of gold on the Main Witwatersrand Reef in 1886, the necessity for supplying the mining industry had led to a steady growth of foundries in South Africa. In the paper, the gold-mining and extraction process was divided into eight sections, *viz.*, mining; transference to reduction work; crushing; milling; sorting; pumping; extracting; smelting; and waste-product recovery. Each was briefly outlined and the provision of castings for the particular process was then described in detail.

The following interesting points emerged:—In 70 years of operation, South African gold production has risen from 2,400 fine ounces valued at £10,000 to 14,500,000 fine ounces valued at £183,000,000. In 1955, the 53 producing mines purchased stores to the value of £94,000,000 of which total £82,000,000 was spent on South-African-made products. On the average, it was necessary to blast five tons of ore from the working face of the rock to produce one ounce of gold, and the approximate time taken from blasting the rock to pouring the final gold bar was 14 days. Immediately after blasting, the scraper shovel removes the rock from the stope. The shovel itself consists of three castings and at each subsequent stage of operation the use of many other castings is evident, until the final pouring of the gold bar (weighing 60 lb. and valued at £10,000) into a cast-iron ingot mould.

In the subsequent discussion, Mr. S. Jane dealt with interesting historical facts linking foundrywork to gold-mining, and the remainder of the discussion dealt mainly with the wear-resisting properties of various metals for tube-mill liners. Mr. S. J. Venning concluded the proceedings by proposing a vote of thanks to the Authors.

Law Cases

Baulks Removed from Moulding Rig

The theory that a foundry worker at the Stafford works of the English Electric Company, Limited, must have removed baulks from a moulding rig which crushed him to death at the foundry was advanced by the Stafford coroner, Mr. K. T. Braine-Hartnell, on March 7, at the inquest on Albert George Simkin (41). A verdict of "Accidental death" was returned.

Mr. William Arthur Clews, safety officer at the works, told the coroner that the removal of the baulk would make the mould rig tilt. With the casting inside it, he said, it would weigh about three quarters of a ton. A step below the bottom of the rig was about a foot deep. A colleague, D. V. Conlon, said that he saw Simkin crouching down below the rig and at the same time he saw the rig tilting. He shouted for help at once and added that he knew Simkin "was going to be crushed." Conlon said that before he could do anything the top boxes started to topple forward and then came down with a rush. The top five boxes caught Simkin in his back and head. Duncan Rhodes, the foundry foreman, said that the tilting could not have taken place if the baulks had not been removed.

Lords Allow Two Appeals

A 61-year-old grinder, Daniel Quinn, on March 14, won his appeal to the House of Lords against a decision that he was not entitled to damages from his employers, Cameron & Roberton Limited, Star Foundry, Southbank Ironworks, Kirkintilloch, in respect of pneumoconiosis alleged to have been brought on by exposure to siliceous dust in the dressing shop. He claimed that the company were at fault in not providing adequate dust-extraction plant.

The House of Lords also allowed an appeal by Mrs. Nicholson, and her children, from a decision of the First Division of the Court of Session that the Atlas Steel Foundry & Engineering Company, Limited, of Armadale, were not liable for damages in respect of the death of her husband, a steel dresser, which occurred from pneumoconiosis in 1951.

AT WALSALL COUNTY COURT on March 7, Judge R. H. Norris awarded £111 3s. 9d. damages with costs to John Walker (53), who had claimed £400 damages and £72 7s. 6d. special damages from the Darlaston firm of Rubery Owen & Company, Limited, for an injury he received on June 14 last year. Walker's little finger on the left hand was amputated after it had been caught in an electric hand-drill.

Publications Received

Survey of Manufacturing Activity in Australia, October, 1956. Published by the Department of Trade, Melbourne; available from the Senior Government Trade Commission, Australia House, Strand, London, W.C.2.

The book opens with a general survey of trading conditions in Australia during 1956, when there was a general recession in activity, but it would appear that business was improving during the final quarter. There are indications that the Australian manufacturer is taking more interest in exports, especially to countries forming the natural Australian market.

The first industry to be covered in detail is the making of steel castings. This is of special interest to founders as the report states "the steelfoundry industry, because of its basic nature, is a reliable indicator of economic trends, especially in capital investment." (The writer always thought it reflected activity in the production of munitions of war; however, he is now inclined to the view taken in the report.) There are about 40 steel foundries in the Dominion. In Victoria, South Australia, production was 20 per cent. lower than in the previous year, but in New South Wales it was steady owing to export orders. As an industry, it is now operating at about 70 per cent. capacity. There is an increasing demand for special steel castings but owing to the scarcity of nickel, progress is being restricted. South East Asia and New Zealand are assuming increasing importance in the export market.

In the ironfounding industry, about 11,000 people are employed in about 400 foundries. The production has declined by more than 20 per cent. and the industry is now operating at less than 60 per cent. capacity. Whilst in most markets there has been a decline in demand, a noteworthy increase has been shown for both malleable and spheroidal-graphite cast iron, mainly for use by the motor-vehicle industry. Few firms are considering major expansions, yet during the last six months it is reported that a new foundry costing £A1,250,000 has come into production in Victoria (Allied Ironfounders, no doubt), whilst a second one—to make automobile castings—costing £A750,000, is being built.

Atlas Métallographic de Microstructures Types d'Alliages Cuivreux (Metallographic Atlas of Typical Microstructures of Copper Alloys) (in French). Issued as a supplement to the December, 1956/January, 1957, issue of the monthly bulletin of the *Centre Technique des Industries de la Fonderie*, 12, Avenue Raphael, Paris, 16.

This 20-page booklet commences with notes on the preparation of specimens for metallographical examination, giving the composition of the various etchants employed. "Magnification" is well defined by means of a series of macro- and micro-photographs of a 90/10 bronze structure; (for five of the illustrations, photographs are taken at ×3, ×12, ×100, and ×1,000 respectively). The next section of the publication illustrates typical structures of various alloys, including a range of brasses of composition from 67/33 to 53/57; aluminium-bronze (Cu 67, Zn 30, Al 1.9 per cent.); tin bronze (Cu 68, Zn 30, Sn 1.7 per cent.); various tin bronzes of compositions from 95/5 to 80/20, also leaded bronzes, copper/aluminium alloys, nickel-bronze and pure copper. Finally, photomicrographs are shown of typical defects that occur in cast-iron, steel, and aluminium alloys. This is the third supplement covering foundry alloys, and if ever the whole is published as one book it would make an excellent contribution to foundry literature.

The Foundry Industry. A revision of No. 19 booklet in the new "Choice of Careers" series issued by the Central Youth Employment Executive; price 1s. 6d. net, from H.M. Stationery Office (with price reductions for quantities).

A number of new and better photographs have been incorporated in this booklet and in these, and in the textual revision, the influence of consultation with practical foundrymen and patternmakers is clearly evident. In the make-up of the contents there are still points about which founders will have varying opinions, and the omission of a good photograph of mechanical charging of a cupola is perhaps an example. However, emphasis is naturally placed on hand working, for that is where craft skills can be acquired and the publishers are correct in not over-glamourizing the jobs offered. Opportunities for advancement are mentioned, but, if anything, they are understressed. With its revisions, this is a much better book than it was and should be brought to the attention of all concerned with youth employment.

Accidents—How They Happen and How to Prevent Them, Vol. 30. Published for the Factory Department, Ministry of Labour and National Service by H.M. Stationery Office, York House, Kingsway, London, W.C.2; price 1s. 3d. net.

It is pleasing to find that no foundry accidents come in for consideration in this issue, but that does not mean it is devoid of interest to foundry executives, as many of the accidents covered could just as well happen in a foundry as in any other works. Electrocution resulting from the recovery of a ball from a gutter, a lorry going over the edge of a tip, are typical of what might occur anywhere.

Technical Survey, No. 9. Issued by the Copper Development Association, 55, South Audley Street, London, W.1.

This very interesting 44-page survey devotes its earlier pages to the foundry industry. Mr. J. L. Rice's "Survey of the CO_2 Process for Core and Mould Making," is praised and dealt with in some detail. These annual reports certainly achieve their objective of keeping people abreast of the latest developments in the working of copper and its alloys.

House Organs

Wild Barfield Heat-treatment Journal, Vol. V. No. 41; issued by Wild Barfield Electric Furnaces, Limited, and associated companies, from Elecfurn Works, Otterspool Way, Watford By-pass, Watford.

This issue contains an excellent illustrated description of the G.W.B.-Leone Tagliaferri hydraulic-control equipment for the electrodes of melting furnaces. The installation described is of a plant operating in the Premier Steel Mills, Limited, of Canada.

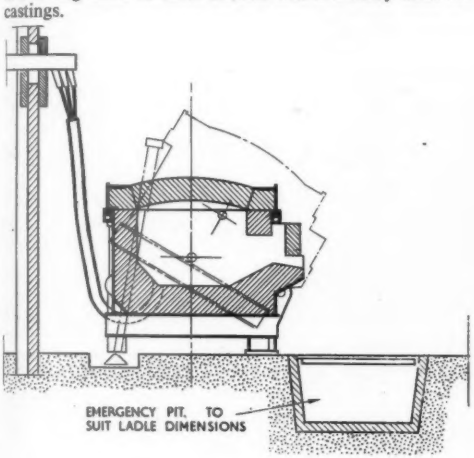
Corn, No. 2, Vol. 1: issued by Brown & Polson, Limited, Wellington House, 125-130, Strand, London, W.C.2.

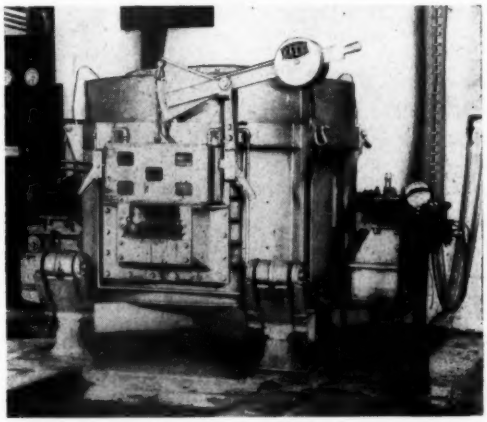
This magazine is to be issued monthly for the employees of the company. The Editress (Geraldine Barry) has a difficult task, for the magazine has to cater for people in Manchester, London, and Paisley, which in truth means the competitions of the bowling club at Paisley have to be written so that they will interest members of the snooker team located in London! The editing of this issue has been well done, and the main article on the growing of maize is obviously of general interest to the whole staff.

Equipment & Supplies

Graphite-resistor Melting Furnace

A new type of British-designed graphite-resistor furnace has been produced by the Electric Furnace Company, Limited, of 17, Victoria Street, London, S.W.1. This furnace is in the form of a squat cylinder and is fitted with a removable roof and front door, similar to the normal arc-furnace body; this design being adopted to obviate the lack of accessibility of the older versions of this type of equipment. The new furnace is available in a range of capacities from 60 lb. to 30 cwt., with power-ratings from 60 to 500 kva. Other advantages claimed are: simplicity of design; robust construction; ease of operation; low installation costs, and constant availability for operation. The first furnace of this type for steelmaking has been installed at Lake & Elliot, Limited, Braintree (Figs. 1 and 2). It is of 15 cwt. capacity rated at 350 kva. and it is being used to melt carbon and low-alloy steel for castings.





FIGS. 1 AND 2.—*Section and front view of the graphite-resistor furnace installed at Lake & Elliot, Limited, the dotted outline indicates the pouring position.*

By reason of the intense radiation from the resistor rod, the lining used must be of high refractoriness and when used for melting steel, using the two-slag method, basic or neutral refractories are essential. The hearth can be rammed with either dry or tarred dolomite, or crushed magnesite and is built up on a sub-hearth of high-alumina firebricks. The sidewalls and roof can be of corundum, sillimanite or dolomite bricks; however, due to the high cost of corundum, the tendency is to build the roof of sillimanite and the walls of dolomite bricks. Alternatively the walls can be constructed of rammed dolomite or magnesite.

Electrical Installation

The incoming supply, at 6.6 kv., is applied direct to a single-phase transformer with the secondary having a range of 40 to 80 v. The resistors become thinner during use, and the furnace transformer is, therefore, wound to provide a range of secondary voltages, increasingly higher voltages being selected during the life of the resistor in order to maintain the rated output to the furnace. The graphite resistor rods, 2-in. dia., carry a current density of approximately 2,000 amps. per sq. in. and are connected to the low-tension supply by copper water-cooled holders which extend through the furnace body into the melting chamber. Efficient air sealing of the electrode-holder apertures is ensured so as to prevent excessive oxidation of the hot graphite rod, and results found in practice indicate that combustion losses of the graphite are small—of the order of 10 to 11 lb. per ton melted depending on the method of working. The graphite rod is held in one of the copper holders while the other end is pressed into a graphite cup by spring loading; it is claimed that changing of resistors can therefore be accomplished quite easily in a few minutes. The furnace is quiet in operation, and absence of moving parts of the electrical system is an advantage for maintenance. Power consumption is dependent on working conditions, but averages approximately 100 kwh. per ton for steel.

Operation

One of the main metallurgical advantages claimed is that the high slag temperatures enable the use of any type of scrap, the composition when steel melting being adjusted by the normal two-slag technique; removal of carbon is facilitated by iron-ore or oxygen injection and the removal of sulphur and phosphorus presents no difficulty. Charging the furnace is accomplished by shovelling, using a peel through the front door, or by top charging. The furnace spout can be tilted by means of two hydraulic rams, for the purpose of removing slag and metal. Temperatures up to 1,700 deg. C. have been obtained in the two-slag process and the low oxidation loss obtained when expensive alloys are being melted is of particular importance.

Solenoid/Piston Valve

A new solenoid-valve designed to handle large volumes of liquids and gases at pressures up to 1,600 lb. per sq. in., has been produced by Teddington Industrial Equipment, Limited, of Sunbury-on-Thames. The valve is arranged either to open or to close when the solenoid is energized. It has two main assemblies, the solenoid-operated pilot-valve and the piston-type main-valve unit.

Company News

RADIATION, LIMITED—Net profit has fallen from £439,482 to £233,573 and a first and final dividend of 7 per cent. is to be paid for 1956. The previous year interim and final totalled 11¼ per cent.

TUBE INVESTMENTS, LIMITED—It is planned to offer to ordinary and preference holders £7,500,000 5¼ per cent. unsecured loan stock, 1977-82, at a price of 95½. Underwriting has been completed. The list will close on April 5.

WOLF ELECTRIC TOOLS, LIMITED—Subject to CIC consent, it is proposed to capitalize £318,395 of reserves in making a 100 per cent. scrip issue to ordinary shareholders and to increase the authorized capital to £1,060,000. The new shares will not rank for the dividend of 20 per cent. (same) now declared.

JAMES BOOTH & COMPANY, LIMITED, tube manufacturers, etc., of Birmingham—The dividend is maintained at 12 per cent., but a sharp reduction in profits is reported, the group profit for 1956 being £359,706, against the previous year's £660,957. The directors state that in 1955 "substantial" profits arose from advances in metal prices, and these were reflected in the accounts for that year. During 1956, however, owing to the fall in the price of copper, stock losses were incurred.

BRUSH GROUP, LIMITED—The company reports that profits fell sharply from £2,339,959 to £1,878,104 in 1956, and no dividend is recommended on the £2,865,413 ordinary capital, against a total of 10 per cent., less tax, for 1955. During the year costs, including wages, salaries, and materials, increased sharply, and there was a heavy increase in bank charges. The company considers that it is too early to forecast 1957 results, but the group received during 1956 more than in 1955, and the order-book is better balanced than for many months past.

GAS PURIFICATION & CHEMICAL COMPANY, LIMITED—It is hoped to maintain the distribution at the annual rate established last year which would result in a payment of 50 per cent. for 15 months. An interim of 1s. per 5s. share has been declared for the extended period to June 30, 1957. The A.B. Metal Company, Limited, the ordinary capital of which was acquired recently, expects to double turnover since concluding an agreement with Standard Coil Products, US. For the year ended March 31, 1956, an interim of 75 per cent. was paid before the capitalization issue, followed by a final of 25 per cent. on the increased capital.

PRESSED STEEL COMPANY, LIMITED—Proceeds of the new £2,000,000 convertible debenture issue will be used to increase production facilities for making tools (about £630,000) and the balance to reducing indebtedness to bankers, which, at February 28, amounted to £1,784,550. The net proceeds of the issue are estimated at £1,938,200. The issue, which carries 5¼ per cent. interest and is redeemable 1977-82, will be offered at par to holders of ordinary, 6 per cent. preference, and 5 per cent. cumulative redeemable second preference, registered on March 18. Holders will have the option to convert into ordinary on June 1, 1958. The last day for application with 10 per cent. deposit is April 2, a further 40 per cent. is due on allotment, and 50 per cent. on May 14. Subject to audit, net profits fell to £713,047 (£958,079). The final dividend is reduced from 15 per cent. to 10 per cent.

THE ELEVENTH SECTIONAL MEETING of the World Power Conference will be held in Beograd, Yugoslavia, from June 5 to 11.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

767,773. Globe Industries Inc., 1784, Stanley Avenue, Dayton, 4, Ohio, USA.

A cast assembly for use in manufacturing a stator or a motor or generator.

768,155. Fairbairn Lawson Combe Barbour, Limited, Wellington Foundry, Leeds, 1, Yorks.

A shell-moulding machine having a heated oven provided with a pair of vertically movable doors. The junction line of these is adjustable in a vertical direction relative to the position occupied by a pattern prior to its entry into the oven. The degree of opening of the doors is controlled by a pre-set device.

768,177. R. E. Warnant, 36, Avenue des Phalenes, Brussels, Belgium.

Improvements in, and relating to, the conversion of iron into steel.

768,207. Regie Nationale des Usines Renault, 8-10, Avenue Emile Zola, Billancourt (Seine), France.

Improvements in the heat-treatment of white cast-iron parts which are graphitized by subsequent annealing. A cycle of three phases is quoted as follow: (1) Austenitization followed by interrupted martensitic quenching; (2) nucleation tempering of the graphite at a temperature of approximately 450 deg. C. (according to composition); and (3) subsequent annealing for graphitization at high temperature (generally between 800 and 950 deg. C.).

768,232. Rolls-Royce, Limited, Nightingale Road, Derby.

The method of producing a mould for precision casting which comprises carrying out the hydrolysis of ethyl silicate in the presence of a stable silica sol and using the resultant liquid to bind the refractory material. The slurry so formed is used to invest an expandable pattern. It is allowed to stand, is gradually heated to a temperature of the order of 1,000 deg. C. and is held at this temperature for at least two hours before casting.

Increases in Capital

WOLF ENGINEERING COMPANY, LIMITED, London, W.1, increased by £9,900, in £1 ordinary shares, beyond the registered capital of £100.

HEIDELBERG PRINTING MACHINERY COMPANY, LIMITED, London, W.6, increased by £99,900, in £1 shares, beyond the registered capital of £100.

S. WHITEHEAD (IRONFOUNDERS), LIMITED, Broadheath (Ches), increased by £9,000, in £1 shares, beyond the registered capital of £3,000.

PANELCRAFT SHEET METAL COMPANY, LIMITED, Woodgate, Birmingham, increased by £10,000, in £1 ordinary shares, beyond the registered capital of £15,000.

COVALLEN ENGINEERING COMPANY, LIMITED, Rushden (Northants), increased by £50,000, in £1 ordinary shares, beyond the registered capital of £3,000.

Recent Wills

FRANCE, WILLIAM, chief engineer of Samuel Osborn & Company, Limited, steel and tool manufacturers, of Sheffield £28,801

BINNIE, DAVID, chief metallurgist of the Lancashire Steel Corporation, Limited, and a director of the Whitecross Company, Limited £10,071

HUNTER, P. V., a director of British Insulated Callender's Cables, Limited, and chairman and director of many other companies £42,502

PROCTOR, VERNON, of Sheffield, former Regional Controller for the Ministry of Supply, Sheffield and Leeds, and in the steel business on his own account from 1921 to 1939 ... ... £23,536

50% INCREASED PRODUCTION!

H.F. HAND GRINDER (above) is Model HS-111a-150 6" dia. Appx. weight 16 lbs. 5,800 r.p.m.

COMPETITIVELY PRICED A.E.G. H.F TOOLS

Inherently safe, operating on 125 Volts 3 phase supply, giving greatly increased power for less weight and having constant speed characteristics, these tools are capable of doing at least 50% more work compared with universal motored tools.

Negligible internal faults: H.F. Motor has no revolving armature winding, no Commutator. No brushes. No damage of carbon dust deposit inside machine. The *A.E.G.* Tools are simple, reliable and safe to use, boosting production by 50% under most arduous conditions. Can be used with suitable existing Convertors, the complete range of these H.F. Tools covers every requirement.

Send now for complete details and prices and state your requirements for demonstration without obligation.

CERTAIN TYPES including Convertors, EX-STOCK.

H.F. ANGLE POLISHER Ref. HWP-11-175. 7" dia.: 7 lbs. 1,400 r.p.m.

H.F. ANGLE GRINDER Ref. HWS-111-150. 6" dia. 14 lbs. appx. 4,400 r.p.m.

H.F. DISC GRINDER Ref. HT-VI-6. 9" dia. 14 lbs. appx. 4,000 r.p.m.

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- One flask does the work of many conventional moulding boxes
- No boxes left idle to rust in the rain
- One flask in use the whole time
- No capital lying idle in boxes waiting to be poured or knocked out, or not in use at all
- The flasks are extendible and the size can be changed as required
- Saving of heavy capital expenditure in many different sizes of boxes
- Double pins are a special and unique feature of these flasks and give easy trouble-free lift-off

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News in Brief

A SEAMLESS, stainless-steel convoluted-hose, specifically designed for use inside nuclear reactor furnaces, has been supplied to the UK Atomic Energy Authority by Power Auxiliaries, Limited.

"PORTRAIT OF AN INDUSTRIAL CITY," a film strip and descriptive booklet on Sheffield, has been produced by two lecturers in geography at Sheffield City Training College, Mr. E. P. Boon and Mr. J. K. Dale.

FRENCH FOUNDRYMEN who participated in the Düsseldorf Foundry Congress, recently held a reunion meeting followed by a dinner. Mr. Georges Blanc and Mr. Pierre Hubert were the speakers at the meeting.

THE TRENT RIVER BOARD announce that they are offering for sale approximately 20 tons of scrap metal. Conditions and forms of tender are obtainable from the Board at P.O. Box No. 74, 206, Derby Road, Nottingham, before March 31.

THE TREASURY have made the Import Duties (Exemptions) (No. 1) Order, 1957, which exempts certain aircraft engines from duty under the Import Duties Act, 1932. The exemption is for a period of 12 months. The Order came into operation on March 20 and has been published as Statutory Instruments, 1957, No. 416.

A MAN WAS BURNED about the face and arms when an explosion occurred in a building adjoining the foundry of the New Electron Foundry, Colliery Lane, West Bromwich. Mr. Graham Lee, the only employee there at the time, received injuries to the upper part of his body and was taken to the Birmingham Accident Hospital; later he was reported to be fairly comfortable.

AN ORDER WORTH £128,148 has been secured by Stanton Ironworks Company, Limited, near Nottingham, from the Dove River Board. The company had submitted a tender for 36-in. dia. pipes of prestressed concrete to form the first six miles of a treated-water aqueduct from the site of the treatment works to be built at Melbourne, to the village of Belton. The tender has been accepted.

BRITISH OXYGEN GASES, LIMITED, have set up a new store at the premises of P. C. H. Johnson (Leverington Transport, Limited) at Terrington St. Clement, Norfolk. It will serve the areas of King's Lynn and Hunstanton. These areas were formerly supplied with gases from the British Oxygen works at Corby, Northants, but supply from there has presented problems due to the rationing of petrol.

THE INTERNATIONAL SHALLWAY CORPORATION are demonstrating shell core-blower equipment at the Milan Fair, April 12 to 28. One new core-blower, designed to produce hollow foundry cores without the use of skilled labour, will accommodate conventional metal coreboxes adapted for blowing along the parting line. The new machine is fully mechanized, and produces approximately 100 cores per hour.

WORKMEN had to leap for safety when an explosion occurred in a casting shop in a Midland factory. It happened at the Neachells Lane premises of Metal Products Company (Willenhall), Limited, and part of the shop was wrecked by the blast. The explosion was caused by the metal from the 15-cwt. ladle running into a water trough. Windows in the factory were blown out but, fortunately, no one was injured.

Mr. JOHN E. BOLTON, chairman and managing director of the Solartron Electronic Group, Limited, has left for a 5-week visit to the North American Continent. He will be attending the Institute of Radio Engineers' exhibition and conference, at which the company has a stand, and part of the trip will be spent visiting Solartron Inc., West Coast Office at Los Angeles, and distributing and servicing agents of the company.

DERITEND PRECISION CASTINGS, LIMITED, Bays Meadow Works, Vines Lane, Droitwich Spa, announce that the works will be closed for the Easter holiday from the evening of Thursday, April 18, to the morning of Wednesday, April 24, and for the Whitsun holiday from 5.30 p.m. Friday, June 7 until 8 a.m. Tuesday, June 11. During these periods goods will not be accepted unless delivery has been specially requested by the company.

BRIERLEY HILL URBAN COUNCIL, at a recent meeting, described the decision of the Ministry of Housing and Local Government to allow the building of a foundry at the back of "first-class residential property" as "shocking and calamitous." A resolution was passed that a letter of protest should be sent to the Ministry, which has granted permission for the building of a foundry in Delph Road to the firm of Rutter Bros. The company had appealed against the Council's refusal to support planning permission for the foundry.

IT WAS ANNOUNCED last week that short-time work has ended at Sheepbridge Stokes, Limited, a Chesterfield factory with 750 employees who are engaged on the production of castings and engine components for the motor-industry. Short-time working at the factory began last July in the casting shop, and later affected 300 machine-shop employees. All the workers are now back on a normal five-day week, and a factory official said last week, "We are back on a full working week for as far ahead as we can see at the moment. The motor-car trade has improved, and their orders are returning to normal."

CONSULTATIONS BETWEEN THE MANAGEMENT and shop stewards at the foundry of Harland & Wolff's Limited, Govan, Glasgow, resulted in a satisfactory settlement of grievances which threatened to result in strike action by 600 foundry workers. The dispute had been over what was alleged by workers' representatives to be high-handed action by a new manager. A demand had been made by the men's representatives for the removal of the manager from his post. Satisfaction has been expressed by all concerned at the outcome of the negotiations. The foundry has had an excellent record of good management-employee relationships for a number of years past.

NEXT MONTH the Bradford engineering firm of Hepworth & Grandage, Limited, makers of internal-combustion and gas-turbine-engine components, celebrates its golden jubilee. On Monday, April 1, a special service will be held in St. John's Church near the St. John's Works, in Wakefield Road, and in the evening of the same day the directors will give a dinner at the Victoria Hotel, Bradford, to over 130 employees who have more than 25 years' service. The guest of honour at the dinner will be Mr. William Hepworth, the only surviving member of the original partners. On Saturday, May 18, as part of the celebrations, all employees with more than a year's service, will be taken in ten special trains on a day's outing to Blackpool.

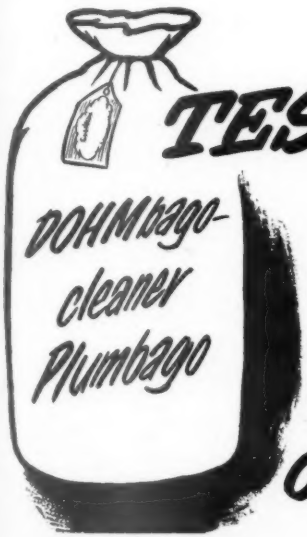
AT THE END of the second year since its formation the Non-Ferrous Club held its annual general meeting at the Queen's Hotel, Birmingham on March 14. In his report to the Club, the chairman, Mr. D. Devereux, said that the year had been very successful and the Club had now grown to a membership of 121 representing 87 companies. Touching on the collections on behalf of various charities which were held at the luncheon meetings he announced that £270 had been

(*Continued on page* 400)

DOHMbago— cleaner Plumbago

Guarantee

The graphite used in DOHMbago is guaranteed to be the same pure graphite as in Atomic Piles. It is also guaranteed free from coal, coke or shale dust. It is cleaner to handle, lighter in weight and colour, and goes much further.



TEST-AT OUR RISK....

We invite you to try 1 cwt. of DOHMbago on the strict understanding that if it is not entirely to your satisfaction you will not be charged and we will collect the balance.

ORDER FORM PAGE 401

News in Brief

(*Continued from page* 398)

collected at the ten meetings throughout the year. During the annual meeting a collection realised a further £20 for the Royal Metal Trades Pension and Benevolent Association. It was announced that Mr. W. Demel would continue in office as president of the Club for the ensuing year.

VARIOUS OBJECTIONS have been made against a Compulsory Purchase Order the Corporation of Dundee is seeking to promote in order to acquire the new Dundee Trades College site. Mr. J. J. Cunningham, Q.C., conducted the inquiry concerning the Order on behalf of the Secretary of State for Scotland. Mr. Alexander T. McIndoe, town planning consultant Edinburgh, stated that from a town planning point of view the College site at Kingsway, Dundee, was not good for a trades college. The ground was zoned for residential housing development. Industrial processes, joinery, carpentry and foundrywork would be carried on in the trades college; a foundry, he said, was an obnoxious industry. The Secretary of State for Scotland will give his decision in due course.

THE UNITED KINGDOM TRADE COMMISSIONER at Madras has reported that Ramakrishna Cements, Macherla, Guntur Dist., Andhra Pradesh, India, are shortly to erect a new cement factory which will have a capacity of 800/1,000 tons per day. Although the plant for this factory has already been ordered there are certain ancillary items still required. These are: (1) Two diesel locomotives. (2) 5-miles of 18, 24 or 30 lb. per yard tramlines for 2 ft. gauge—complete with fish-plates, points and crossings, round-tables and switches. (3) Tipping Wagons: of one cubic yard capacity. Steel body complete with buffers, axle springs and axle boxes. This equipment is needed for transporting limestone to the cement factory at Macherla from a quarry situated at a distance of about 5 miles. Reference ESB/3898/57.

PROFESSOR C. A. COULSON, Rouse Ball Professor of Applied Mathematics at Oxford University, told Sheffield University students on March 18, that atomic energy came only just in time. He said, "In 50 years' time we shall require power at such a rate that the whole amount of oil in the earth will last only ten years. In A.D. 2,000 our coal stocks will last only 100 years." Speaking on the moral and ethical aspects, he said "the atomic age had brought problems of a kind that needed much thinking about if responsible action was to be taken with regard to unborn generations. It seemed very probable that the atomic explosions already carried out would have caused the death or mutilation of 30,000 human beings. The results were not immediately obvious and it may be ten generations—or roughly 300 years—before the results of some of the explosions which had already taken place would be revealed."

ORGANIZED by the Society of Industrial Engineers in association with the Work Study Society, a one-day conference on work-study was held in Birmingham on March 14. Mr. F. F. Bowsher, cost accountant of the Bound Brook Bearings, Limited, urged managements to give an enthusiastic lead in the introduction of work-study in factories. One of the biggest obstacles to the raising of productivity by the system was a resistance to chance shown by employers as well as workers, he said. Mr. J. G. Barton assistant administrative manager of Chance Bros., Limited, gave examples of how work-study systems had reduced the internal transport costs at his own factory by more than 15 per cent. and increased the earnings of drivers by 30 per cent. In another department four phases of a production process in one department had been reduced to a single phase and boosted output by 100 per cent. with no extra labour. Another paper at the conference was given by Mr. T. Farrer, works director of J. B. Brooks, Limited.

Mr. STAFFORD BEER, recently appointed in charge of the United Steel Companies, Limited, new department of operational research and cybernetics, gave the George Bray Memorial Lecture to the Institution of Production Engineers at Sheffield City Memorial Hall on March 18. He said, "There is great scope for increasing productivity and yet, within the system which is being worked, intense human effort cannot make much impression." Even "sweated labour" in present conditions could raise productivity by only two or three per cent.; but by improving the "organic behaviour" of works by operational research something between 20 and 50 per cent. increased productivity could be obtained. "There is a new dimension of industrial management to be discovered; the cybernetic dimension, the dimension of liveliness. Cybernetics is a new and scientific and industrial target of immense potential. I say in all seriousness, that cybernetics will ultimately join atomic energy in reshaping the world. And operational research is industry's best tool, indeed its only mechanism, for working towards this future.".

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

VIETNAM—Textile, printing, moulding, woodworking and sugar production machinery, for ICA commercial procurement for Vietnam. (ESB/6740/57/ICA.)

INDIA—Complete automatic-plant for the manufacture of hacksaw blades. (ESB/5137/57.)

SOUTH AFRICA, April 12—Cast-iron and cast-steel chain, for the South African Railways. (ESB/6551/57.)

SOUTH AFRICA, May 3—Shaping machinery, for the South African Railways. (ESB/7044/57.)

SOUTH AFRICA, April 11—Grinding and honing machines, for the Union Tender and Supplies Board. (ESB/7039/57.)

SOUTH AFRICA, April 25—Metal-turning lathes, for the Union Tender and Supplies Board. (ESB/7038/57.)

SOUTH AFRICA, April 26—Centre lathes, for the South African Railways. (ESB/7043/57.)

SOUTH AFRICA, April 18—Milling machine, for the Union Tender and Supplies Board. (ESB/7023/57.)

CEYLON, May 6—Portable electric-generators, for ICA procurement for Ceylon. (ESB/6720/57/ICA.)

SOUTH AFRICA, April 12—Crucibles and parts, for the South African Railways. (ESB/6959/57.)

INDIA, April 15—Diesel locomotives, for the Madras Port Trust. (ESB/6979/57.)

KOREA—Aluminium and aluminium-base alloys and aluminium products (PA No. 89-691-99-G2-7253) to the value of $200,000. Zinc, zinc-base alloys and zinc products (PA No. 89-697-99-G2-7254) to the value of $200,000. Zinc, zinc-base alloys and zinc products (PA No. 89-697-99-G3-7255). Authorized by ICA procurement for the Republic of Korea. (ESB/7137/57/ICA.)

STAFFORD—Spun-iron water-pipe for the Eastern area water scheme, for the Borough of Stafford. Deposit £5 5s. 0d. Mr. T. B. Nowell, Town Clerk, Borough Hall, Stafford.

NELSON, April 6—Castings for the year ending March 31, 1958, for the Borough of Nelson. Mr. F. W. Roberts, Town Clerk, Town Hall, Nelson.

INDIA, April 1—Pumping sets, for the Government of Madras Public Works Department. (ESB/6783/57.)

INDIA—Surfacing and boring lathe, for the Mysore iron and steel works. (ESB/6861/57.)

URUGUAY, March 29—Silicon/manganese-steel bars for springs. Deposit Ur$200. (ESB/6474/57.)

PHILIPPINES, March 30—Machine-shop tools, laboratory equipment, agricultural equipment, for the International Co-operative Administration Procurement for the Philippines. (ESB/6688/57/ICA.)

Better-Cheaper-castings! with DOHMfrac PRE-COATED SAND

The most-widely used PRE-COATED SAND

The technically controlled size of resin coated sand grains gives uniform strength and consistency of mixture which makes DOHMfrac the most widely used pre-coated sand for precision casting

Cored and cemented: the shell is ready for closing. Clean cut castings with perfect right angles.

More uniformly well finished cores per hour with little casting scrap.

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SEND THIS COUPON TODAY AND START IMPROVING PRODUCTION

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SEE PAGE 399

(1) Please send me 1 cwt. bag of DOHMbago (at 68/- per bag ex works) for which we only pay if satisfied. Please send literature/ representative about :

(2) DOHMfrac for shell moulding and cores.

(3) Investment Base.

(4) CO_2 Process

NAME (Executive).....

NAME OF FIRM.....

ADDRESS .....

.....

Personal

Mr. K. G. SINCLAIR has been appointed chairman of Griffin & George, Limited, laboratory furnishers.

Mr. N. I. BOND-WILLIAMS has been appointed an additional director of Enfield Rolling Mills, Limited.

The Tube Investments Research Fellowship in Metallurgy at Sheffield University has been awarded to Mr. G. F. MODLEN.

The sales director of Qualcast, Limited, Derby, Mr. T. W. D. COOPER, has been appointed joint assistant managing director of the company.

Mr. AUSTIN KELLY, naval architect to Vickers-Armstrongs (Shipbuilders), Limited, has retired from the company's service on reaching retiring age.

Mr. K. C. LODGE, secretary and commercial manager of Owen & Dyson Limited, railway-wheel makers, Rother Ironworks, Rotherham, retires during this month. He joined the firm in 1911.

Mr. A. D. BARNSDALE, late of Coventry Gauge & Tool Company, Limited, has been appointed to the position of sales manager of Tappex Thread Inserts, Limited. He will be operating from the company's sales office at 46, High Street, Warwick.

Mr. E. G. P. HINDS, Foundry Services, Limited, overseas technical representative for the Benelux countries, has left for Portugal where he is to make an intensive study of the foundry industry, in close association with the company's local agents.

Mr. H. RICHARDS, chairman and joint managing director of Wolf Electric Tools, Limited, Pioneer Works, Ealing, London, W.5, has been presented by the directors with a tape recorder, and by the staff with a silver cigar box, on completing 50 years' association with the firm.

Mr. F. ANDREW FIELD, home sales manager of Black & Decker, Limited, manufacturers of portable electric tools, of Harmondsworth (Middx), since 1953, is leaving the company at the end of this month to become managing director of Eutectic Welding Alloys Company, Limited.

LORD ELGIN, chairman of the Fairfield Shipbuilding & Engineering Company, Limited, Glasgow, since October, 1954, has announced his intention of retiring. He is 76. Lord Elgin, who is a director of a number of companies, is also vice-president of the Scottish Council (Development and Industry).

Mr. DAVID MACKIE has been appointed manager of the heavy engineering foundry of Carron Company, Falkirk, Stirlingshire. Mr. Mackie served his apprenticeship with Melville & Brodie, Limited, ironfounders, Kirkcaldy, and after leaving this firm he was employed for 12 years with Henry Balfour & Company, Limited, ironfounders, Leven.

The Mond Nickel Fellowships Committee announce that an additional award for 1956 has been made to Mr. G. F. C. DU PLESSIS (South African Iron and Steel Industrial Corporation Limited, Pretoria, South Africa) to study the preparation of ores by sintering, pelletizing, etc., and the effect on blast-furnace practice of the use of prepared burdens.

It is announced that Mr. S. W. EVANS and Mr. DOUGLAS BRUCE-GARDNER have been appointed to the board of Guest Keen Iron & Steel Company, Limited. Mr. Evans is works manager at the company's East Moors Works, Cardiff and Mr. Bruce-Gardner is director and joint general manager of John Lysaght's Scunthorpe Works, Limited.

Mr. J. CUTHBERT ROBINSON, chairman of Thomas Robinson & Son, Limited, Rochdale, has been elected president of the Machine Tool Traders' Association for the year 1957-58 in succession to Mr. H. P. Potts. Mr. Robinson has served on the Council of the MTTA since 1925, and he has been chairman of the Woodworking Machinery Manufacturers' section since the re-organization of the Association in 1941.

Mr. C. L. OLD, principal of the Wolverhampton and Staffordshire College of Technology since 1951, has been appointed group adviser, education and training, to Vickers, Limited. He is to take up the post in September. During his career Mr. Old has taught general mechanical engineering at the Manchester College of Technology and has been vice-principal of the Royal Aircraft Establishment's Technical College and principal of the Rotherham College of Technology.

Mr. T. W. COOPER, who is leaving the Chance Technical College where he has been principal for five years, is to become education officer for the Institution of Production Engineers. At a ceremony on March 20, he received from Mr. J. W. Berry, joint managing director of the Birmingham Aluminium Casting Company, Limited, a presentation on behalf of the 48 firms in the area whose apprentices attended the college. He has also received a presentation from the staff and students of the College.

Health reasons have forced Mr. ARTHUR TAYLOR, a director and group chief engineer of the South Durham Steel & Iron Company, Limited, to resign his appointments. Mr. Taylor began his career at the Britannia works of Dorman Long & Company, Limited, Middlesbrough, and later spent 10 years at the Irlam works of the Lancashire Steel Corporation. He joined South Durham Steel & Iron Company in 1940 and was appointed to the board in 1951. Mr. Taylor's services are being retained in a consultative capacity.

Obituary

Mr. EDWARD HARRY BRAMLEY, a director of Walker Bros., Limited, constructional engineers, of Walsall (Staffs), has died at the age of 55.

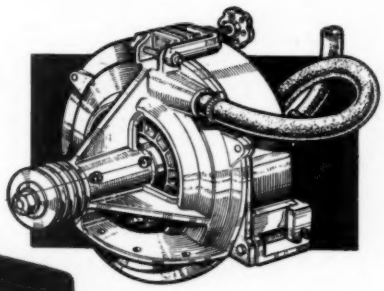
Mr. A. E. THORNTON, who has died at the age of 68, was formerly chief administrative assistant at Rolls-Royce, Limited, until his retirement in 1953.

Mr. HAROLD EDGAR CLEGG, for some 20 years a member of the sales department of F. Perkins, Limited, diesel engine manufacturers, of Peterborough, has died at the age of 61. He pioneered the company's Continental sales department, and from 1950 to 1955 was resident sales and service representative in Paris.

THE INSTITUTION OF MECHANICAL ENGINEERS announces that owing to the postponement of the annual general meeting from March 22 to April 26, the general meetings arranged for April 12 and 26 will now take place on May 3 and May 17 respectively. Two papers—"Influence on Dynamical Imperfection on the Vibration of Rotating Discs," and "Free Undamped Non-linear Vibrations of Imperfect Circular Discs"—will be presented to the meeting on May 3, and "Diesel-engine Lubricants—their Selection and Utilization with Particular Reference to Oil Alkalinity" will be presented on May 17. On Friday, May 10, at 6 p.m., Professor Walther Bauersfield will deliver the James Clayton lecture entitled "Projection Planetarium and Shell Construction."

Shot Blast Equipment

This A-S-L Turbine is the most modern Shot Blasting Unit available. The bi-phase air injection system enables shot to be projected at greater speeds using lower power with fewer replacements. The economies effected in spare parts alone are very substantial.



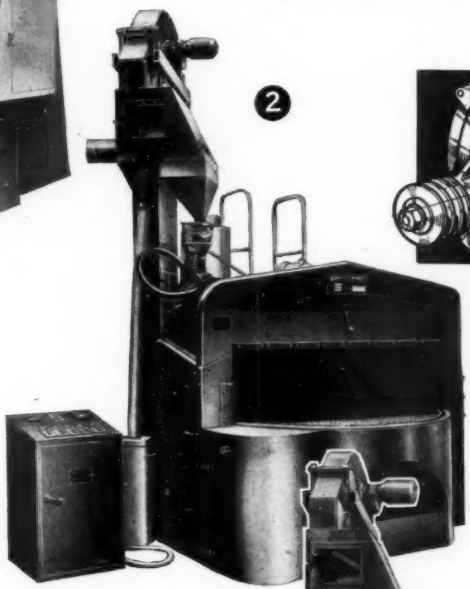
Baker Perkins High Speed Bi-Phase A-S-L Turbine, British Patent, No. 510681.

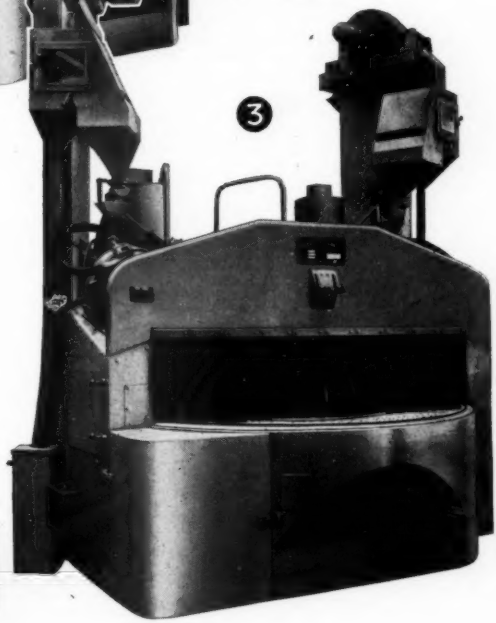
These machines do not require pits or special foundations.

1 ROTARY BARREL

2 CADET

3 MEDIUM





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Raw Material Markets

Iron and Steel

The increased tonnages of pig-iron now being produced are comprised mainly of basic pig-iron for the steelworks, which continue to have prior claims on supplies to the extent of more than three quarters of current production. Requirements are not satisfied fully, particularly in some areas where consumers are dependent on pig-iron from abroad to assist in overcoming the shortage. Producers have little difficulty in fulfilling current demands for pig-iron from the foundries. Improved trading conditions in the motor-car industry have not been reflected in the low-phosphorus and hematite grades from the engineering foundries which cater for them. This is no doubt due to the stocks of castings on hand and to the fact that increased schedules for supplies will be issued when these stocks diminish. Adequate tonnages of pig-iron are available for the engineering and speciality foundries in the normal grades used by them. Stocks at the furnaces and the foundries are not large and a small overall increase on present intake would absorb this excess quickly.

Only moderate demands for high-phosphorus pig-iron continue to be made from the light foundries and there is as yet no sign of any improvement in the call for light castings. Makers of castings for the domestic utensil trade are slack and only fair demands are being made for builders' castings. The foundries making gutters and pipes are fairly busy. Jobbing foundries are also obtaining good outputs, but textile foundries are in need of more work. Some of the engineering foundries which use the high-phosphorus irons are taking up good tonnages, but present outputs are more than sufficient to cope with the needs of all users. In fact, makers report that business is now at a lower level than it has been for some time.

Most of the re-rollers have fairly satisfactory supplies of steel semis, although recent outputs of small bars, light sections, and other products have reduced stocks to an undesirable level, present deliveries from home steelworks being insufficient for current usage and for supplementing stock. Pressure has therefore become heavier on home suppliers on whom the re-rollers mainly rely for their steel. Some consignments continue to arrive from abroad, but nothing near so heavy as before. Heaviest pressure is made for small-sized billets, carbons, and special-quality steels, although most sizes and grades of steel are in demand. The re-rollers continue to be fairly well off for work, with most of their outputs going to home consumers and stockists. Small bars are not so heavily in demand and, when licences can be obtained, outputs permit of consignments being sent overseas.

Non-ferrous Metals

In a statement issued by the International Tin Council on Friday it was announced that the decision to raise the floor price in the international tin agreement from £640 a ton to £730 a ton was reached without opposition. The intermediate price ranges have also been adjusted upwards, but no change has been made in the ceiling price, which remains at £880 a ton. The new prices come into effect immediately. Thus the present position is that the manager of the buffer stock must buy tin when it is below £730 a ton, use his own discretion when the price ranges between £730 and £780 a ton, and must not either buy nor sell when the price is between £780 and £830 a ton. However, the manager may sell tin when the price is over £880 a ton. The increase in the floor price was greater than had been expected, and although it will definitely help Bolivia and Indonesia, where output has been falling away in recent years, it may not be welcomed in the United States.

In so far as the metal markets are concerned, demand for tin is steady in both London and in New York, where the price is once more above $1.00 a lb. Stocks in the UK are now definitely on the increase. In the East, prices are firm on the raising of the floor price under the ITA and also perhaps by the fact that a state of war and siege has been declared throughout Indonesia. What effect this will have on the output of tin remains to be seen.

Demand for copper in London is poor and prices continue their downward drift. However, the US producers have served notice that they intend to try and keep the quotation up to the 32 cents a pound level. As previously reported in this column, Phelps-Dodge has cut back production and now there is the news that two US producers—both small—are preparing to close down, thus the O'Kiep Copper Company in South-west Africa is reducing its output and, the rumour has even been heard that the Northern Rhodesian Copper-belt producers are toying with the idea. This does not make much sense, as their costs are sufficiently low to give them a good profit margin with prices at their present levels. In London the improved supply position has eliminated the backwardation and brought back a contango, which, it is hoped, will become a permanent feature.

Lead is quiet—more so than usual because of the unsettled labour conditions. Yet there are no appreciable stocks overhanging the market. In America the quotation remains at 16 cents a pound. Zinc is also quiet because of the doubts about the future course of the engineering strike, although, as for lead, no unwieldy stock position is pressuring the price.

Forthcoming Events

APRIL 1

Institute of British Foundrymen

Sheffield and district branch:—Annual general meeting followed by film "Flow of Metal into Moulds," 7 p.m., at the Sheffield College of Commerce and Technology, Department of Engineering, Pond Street.

Institute of Industrial Supervisors

Slough section:—"The Foreman and Work-study," 7.30 p.m., at High Duty Alloys, Limited, Buckingham Avenue, Farnham Road.

APRIL 3

Incorporated Plant Engineers

Southern branch:—"Industrial Diseases," by K. Biden-Steele, M.D., 7.30 p.m., at the Grand Hotel, Bournemouth.

APRIL 4

Institute of Metals

London local section:—Annual general meeting followed by "Recent Developments in Electron Microscopy," by J. Nutting, B.SC., PH.D., 6 p.m., at 17, Belgrave Square, London, S.W.1.

Leeds Metallurgical Association

"Fatigue in Metals," by P. J. E. Forsyth, 7.15 p.m., at the Large Chemistry Theatre, The University, Leeds.

APRIL 5 to 7

British Institute of Management

Regional Conference: "Meeting Tomorrow's Problems," at Droitwich.

APRIL 6

Institute of British Foundrymen

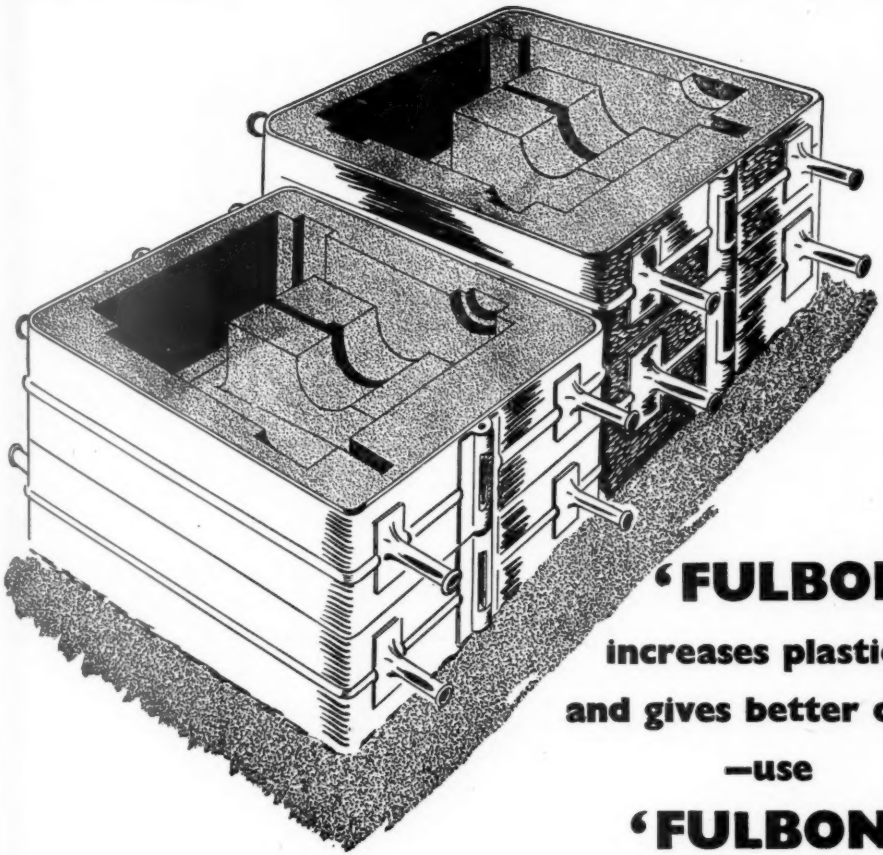
Lancashire branch:—Annual general meeting, John Wilkinson Memorial presentation, and "Practical Experiences with a Water-cooled Cupola," by F. Lord, 3 p.m., at the Midland Hotel, Manchester.

APRIL 9 to 10

Birmingham and District Industrial Training Centre

Course for industrial truck drivers. Details from the secretary, W. G. Appleyard, 21, Steelhouse Lane, Birmingham, 4.

DEEP DRAWS...



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CHF13

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

March 27, 1957

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £20 1s. 0d.; Birmingham, £19 13s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £21 18s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £22 2s. 3d.

Scotch Iron.—No. 3 foundry, £23 4s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £24 6s. 6d.; South Zone, £24 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £25 14s. 0d.; South Zone, £25 16s. 6d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £22 17s. 6d.; Scotland (Scotch iron), Zone S. 1, £23 4s. 0d.; Sheffield, £24 4s. 6d.; Birmingham, £24 12s. 0d.; Wales (Welsh iron), £22 17s. 6d.

Basic Pig-iron.—£19 3s. 0d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £50 0s. 0d. to £53 5s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £76 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 28s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 12s. 3d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £250 0s. 0d.; 38/40 per cent., £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 12s. 1d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 15s. 1d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £96 0s.0d. to £99 10s. 0d., basis 60 per cent. Cr, scale 33s. 0d. per unit; over 6 per cent. C, £94 0s. 0d., basis 60 per cent. Cr, scale 31s. 0d. to 33s. 0d. per unit; 2 per cent. C,* 2s. 2d. per lb. Cr.; 1 per cent. C,* 2s. 2½d. per lb. Cr; 0.15 per cent. C,* 2s. 3d. to 2s. 3½d. per lb. Cr; 0.10 per cent. C,* 2s. 3½d. to 2s. 3¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3¾d. to 2s. 4d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent. Nb + Ta, 22s. 0d. to 23s. 0d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £82 12s. 6d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £30 9s. 0d.; tested, 0.08 to 0.25 per cent. C, £31 9s. 0d.; hard (0.41 to 0.60 per cent. C), £32 10s. 6d.; silico-manganese, £41 0s. 0d.; free-cutting, £34 13s. 0d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £38 4s. 6d.; silico-manganese, £41 7s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £36 3s. 6d.; basic, hard, over 0.41 up to 0.60 per cent. C, £37 6s. 0d.; acid, up to 0.25 per cent. C, £40 7s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £39 2s. 0d.; boiler plates (N.-E. Coast), £41 12s. 0d.; floor plates (N.-E. Coast), £40 11s. 0d.; sectional material, N.-E. Coast, £37 11s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in. untested (4-ton lots), £37 18s. 0d.; flats, 5 in. wide and under (4-ton lots), £37 18s. 0d.; hoop and strip, £37 17s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £41 6s. 0d.; black sheets (hand mill), 17/20 g., £52 4s. 6d.; galvanized corrugated sheets, 24 g., £65 9s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £64 13s. 9d.; nickel-chrome, £88 15s. 3d.; nickel-chrome-molybdenum, £100 13s. 9d.

NON-FERROUS METALS

Copper.—Cash, £239 10s. 0d. to £239 15s. 0d.; three months, £240 5s. 0d. to £240 10s. 0d.; settlement, £239 15s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 3½d. per lb.; rods, 267s. 6d. per cwt. basis; 20 s.w.g., 309s. 9d. per cwt.

Tin.—Cash, £782 0s. 0d. to £784 0s. 0d.; three months, £771 10s. 0d. to £772 0s. 0d.; settlement, £784 0s. 0d.

Lead (Refined Pig).—Second half March, £112 15s. 0d. to £113 0s. 0d.; second half June, £112 0s. 0d. to £112 5s. 0d.

Zinc.—Second half March, £96 0s. 0d. to £96 10s. 0d.; second half June, £94 5s. 0d. to £94 15s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £128 10s. 0d.; rolled zinc (boiler plates), all English destinations, £126 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £105.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 11½d. per lb.; rods, drawn, 2s. 11d.; sheets to 10 w.g., 206s. 6d. per cwt.; wire, 2s. 8½d.; rolled metal, 206s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £177; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £234; HTB2 (38 tons), — ; HTB3 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £234; LG3 (86/7/5/2), £246; G1 (88/10/2/½), — ; (88/10/2/1), £290.

Phosphor Bronze.—BS1400, PB1 (AID released), £309 per ton.

Phosphor Bronze Strip, etc.—Strip, 290s. 0d. per cwt.; sheets to 10 w.g., 290s. 0d. per cwt.; wire, 4s. 0½d. per lb.; rods, 3s. 3¾d.; tubes, 3s. 3¾d.; chill cast bars: solids 3s. 3½d., cored 3s. 4½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 10d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 2¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 1¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £85 10s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, £260; AB2, £264. Solder, brazing, BS1945, type 8 (50/50), — per lb., type 9 (54/46), — per lb.

* Average 68-70 per cent.